

(12) **United States Patent**
Pulitzer et al.

(10) **Patent No.:** **US 10,255,729 B1**
(45) **Date of Patent:** **Apr. 9, 2019**

(54) **SYSTEM AND METHOD FOR HAPTIC
MAPPING OF A CONFIGURABLE VIRTUAL
REALITY ENVIRONMENT**

(56) **References Cited**

U.S. PATENT DOCUMENTS

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(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.

4,934,858 A * 6/1990 Beaulieu F16B 12/40
211/192
2006/0084356 A1 * 4/2006 Stallworth A63H 33/42
446/82
2009/0187264 A1 * 7/2009 Hashimoto G05B 19/4097
700/98
2010/0294340 A1 * 11/2010 Cunningham H02S 20/00
136/251
2013/0067846 A1 * 3/2013 Kvols E04H 1/1205
52/586.1
2016/0253842 A1 * 9/2016 Shapira G02B 27/017
345/633
2017/0354064 A1 * 12/2017 Milek H05K 7/1497
2018/0151000 A1 * 5/2018 Liv G06T 19/006
2018/0168064 A1 * 6/2018 Gustaferrero H05K 7/1488

* cited by examiner

(21) Appl. No.: **15/991,686**

(22) Filed: **May 29, 2018**

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(51) **Int. Cl.**
G06T 19/00 (2011.01)
G02B 27/01 (2006.01)
G06F 3/01 (2006.01)
E04B 1/19 (2006.01)

(57) **ABSTRACT**

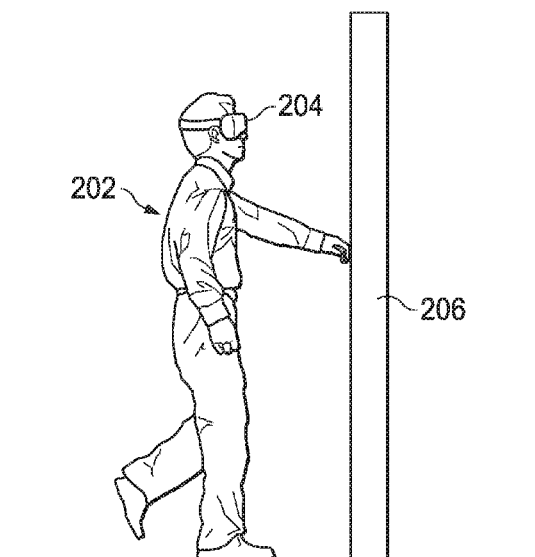
(52) **U.S. Cl.**
CPC **G06T 19/006** (2013.01); **E04B 1/19**
(2013.01); **G02B 27/0176** (2013.01); **G06F**
3/012 (2013.01); **G06F 3/016** (2013.01); **G06T**
19/003 (2013.01); **E04B 2001/1936** (2013.01);
E04B 2001/1966 (2013.01)

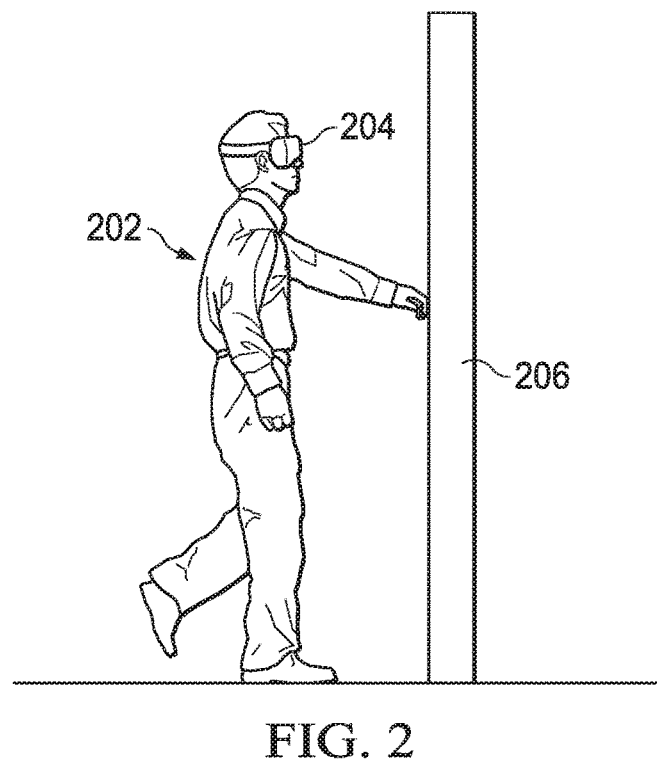
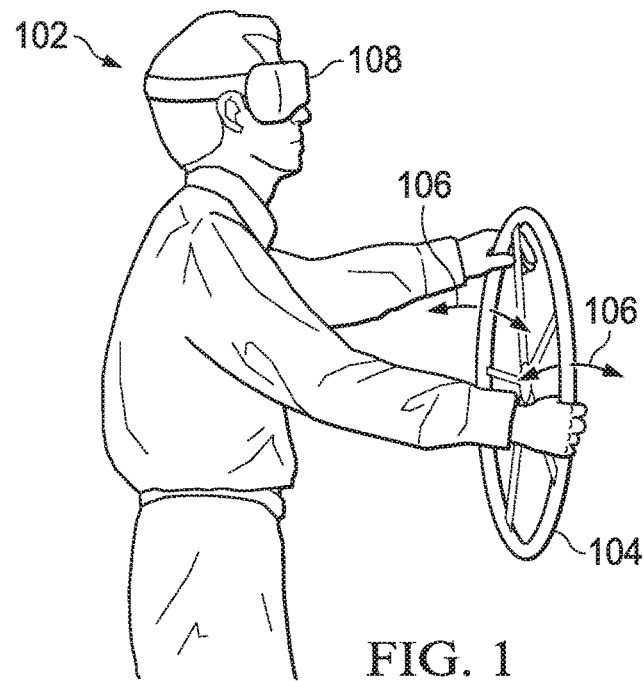
A system for providing a virtual reality experience includes a display associated with a field of view of a user. A virtual reality system renders a virtual reality world responsive to a movement of the user and displays the rendered virtual reality world to a user through the display. A configurable virtual reality environment model may be configured to place physical walls in a location that corresponds to a virtual wall located within with virtual reality world such that when the display shows the user touching a wall in the virtual reality world, the user feels the physical wall placed in the configurable virtual reality environment.

(58) **Field of Classification Search**
CPC G06T 19/006; G06T 19/003; G06F 3/012;
G06F 3/016; E04B 1/19; E04B
2001/1936; E04B 2001/1966; G02B
27/0176

See application file for complete search history.

20 Claims, 19 Drawing Sheets





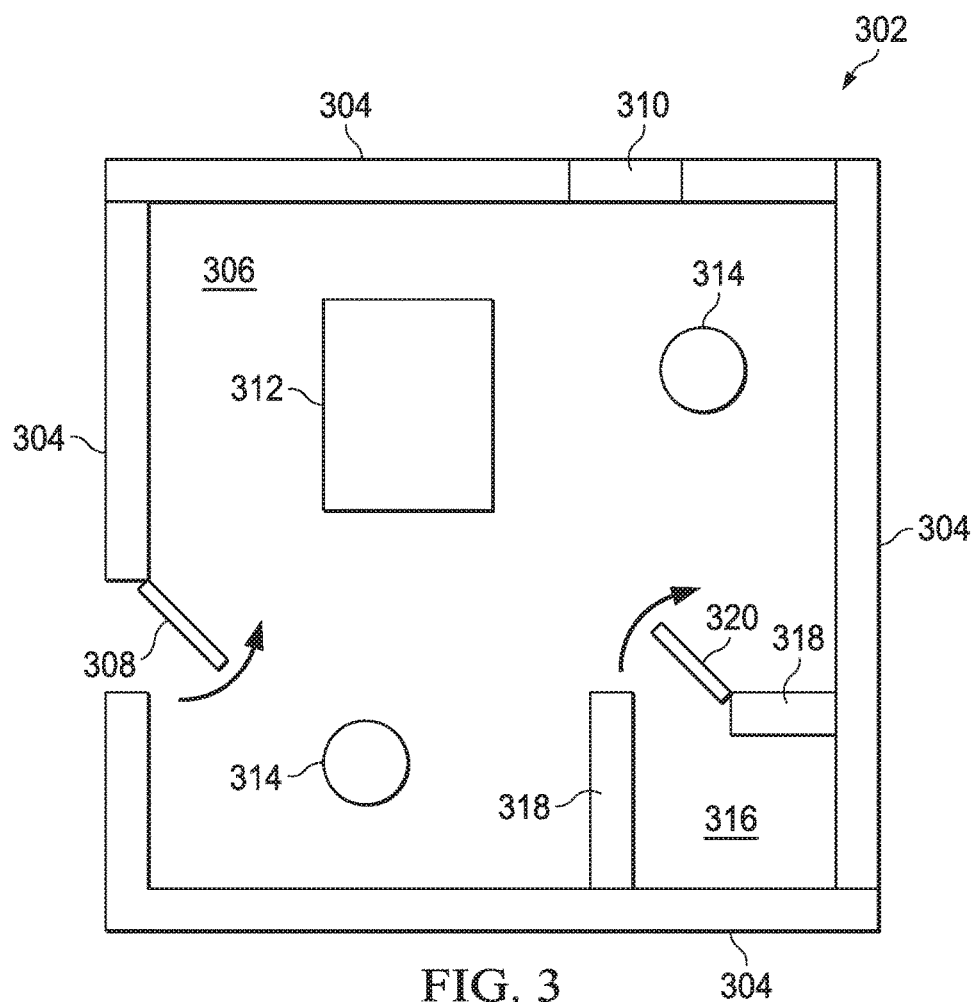
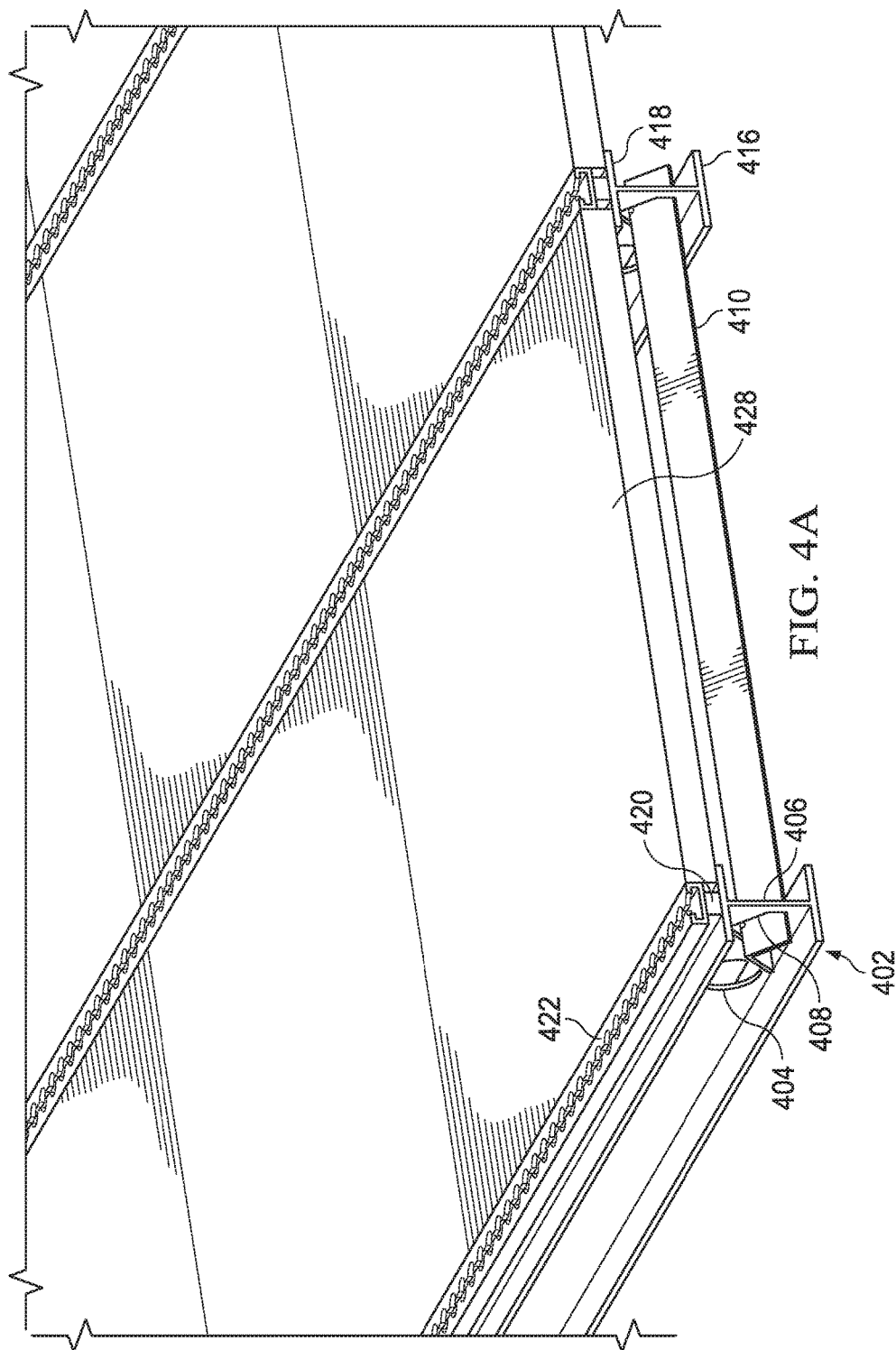


FIG. 3



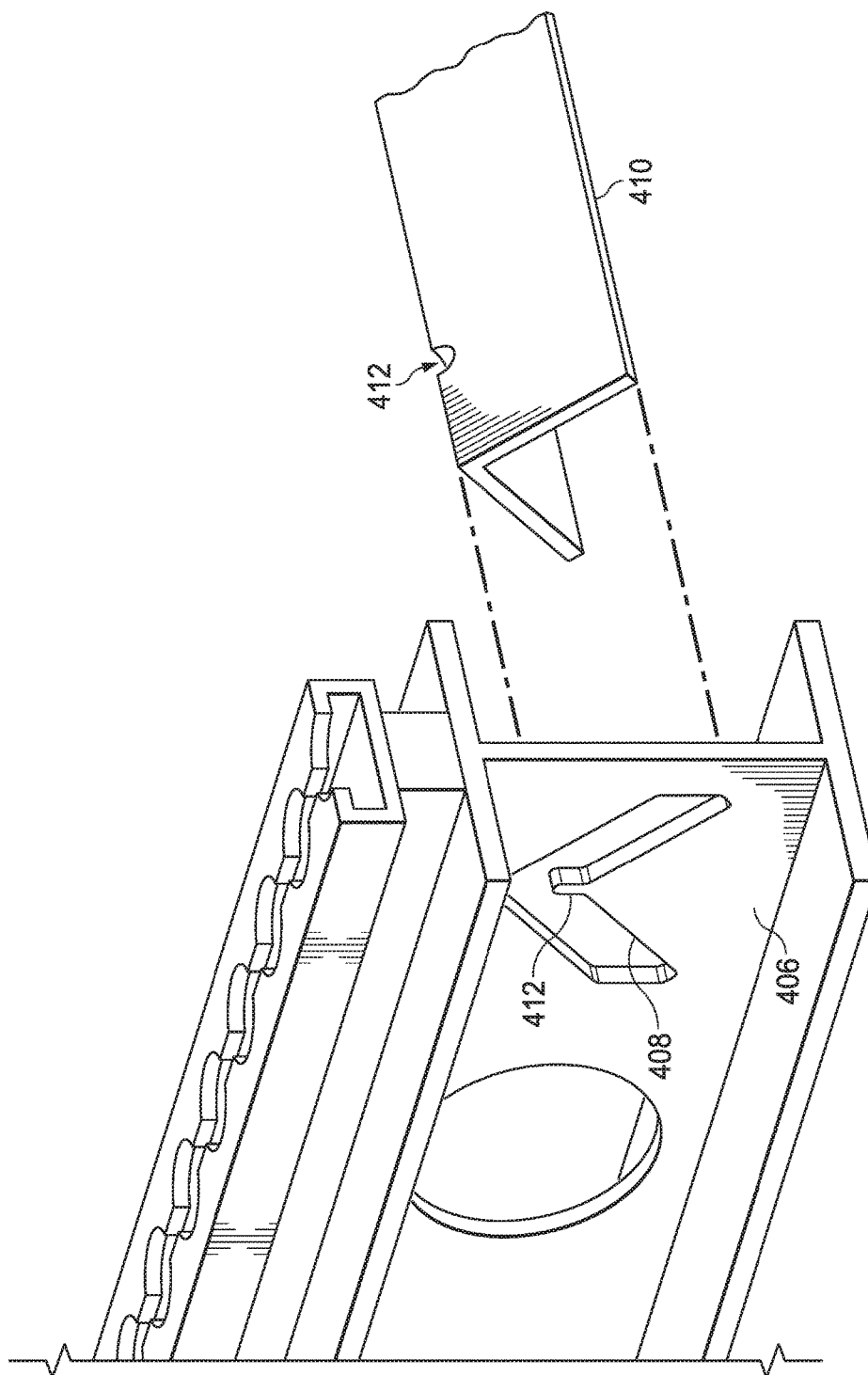
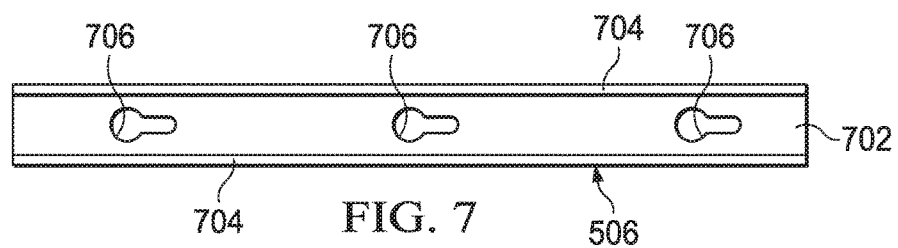
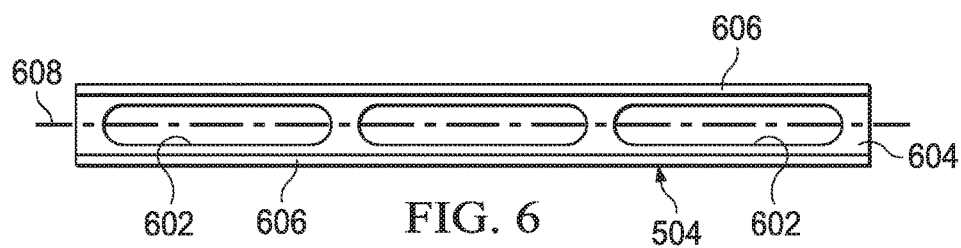
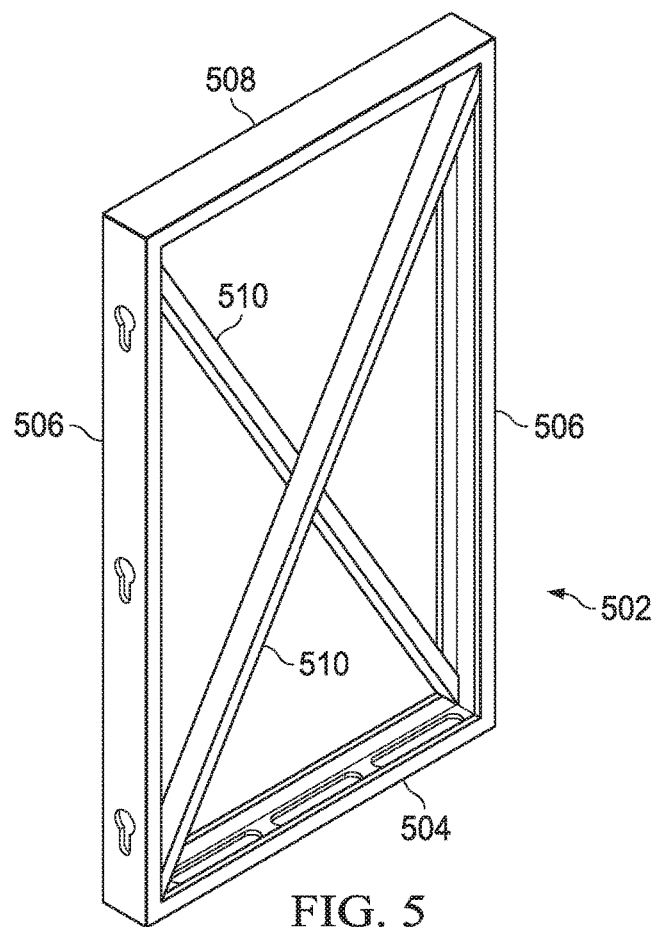
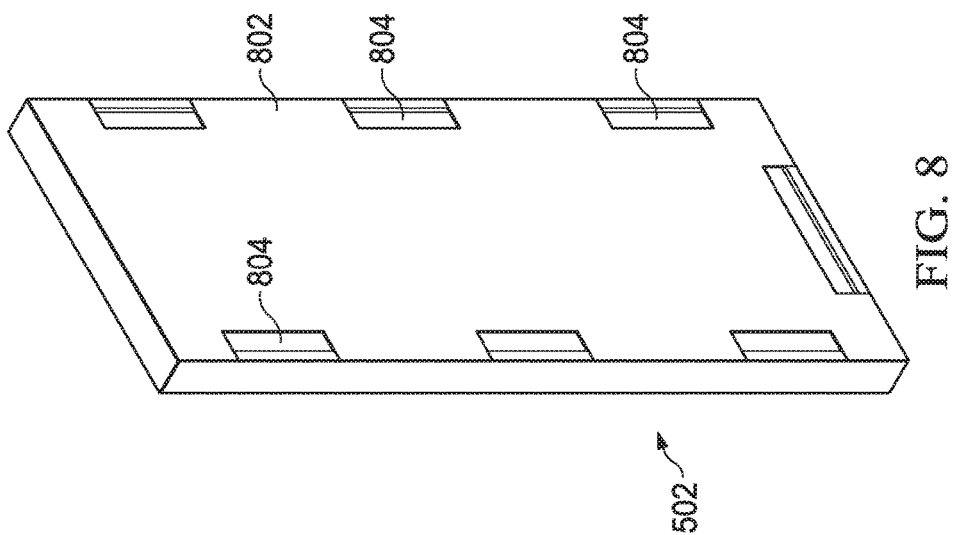
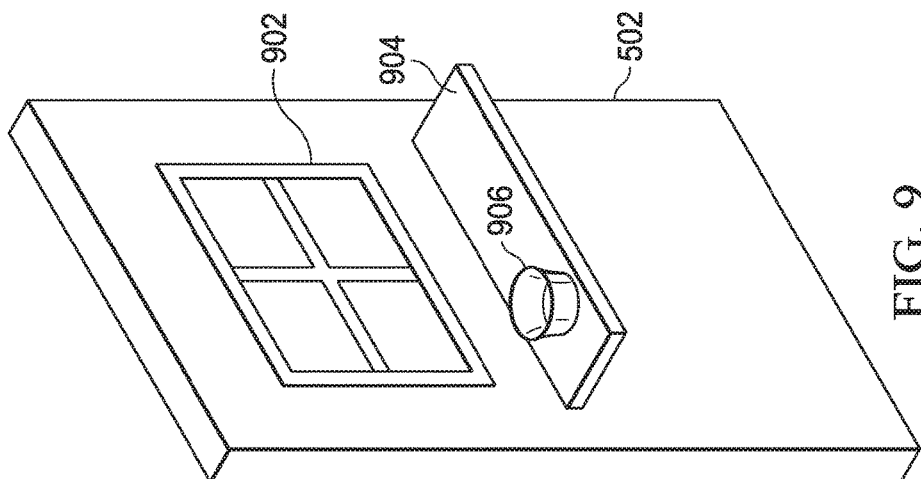


FIG. 4B





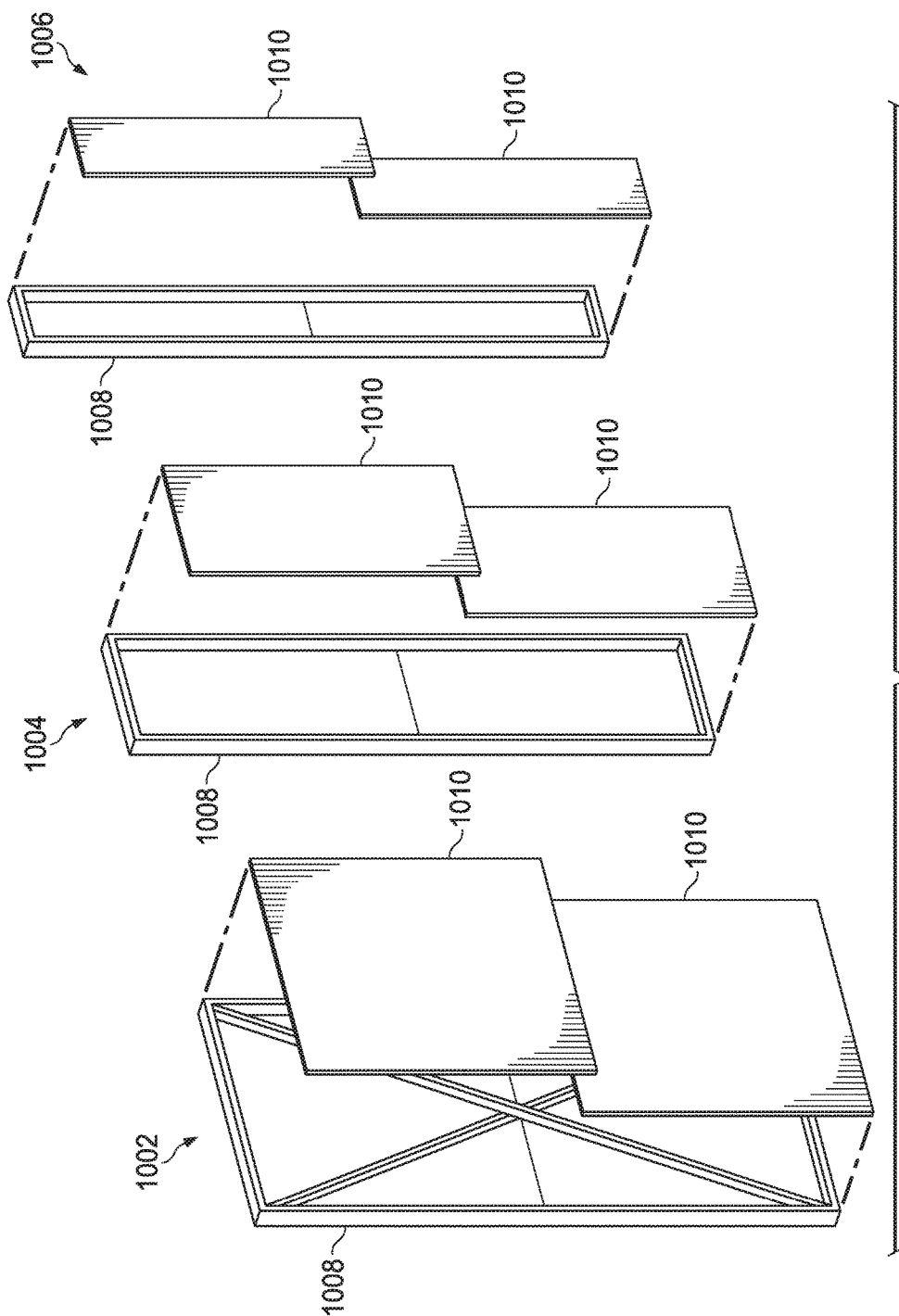
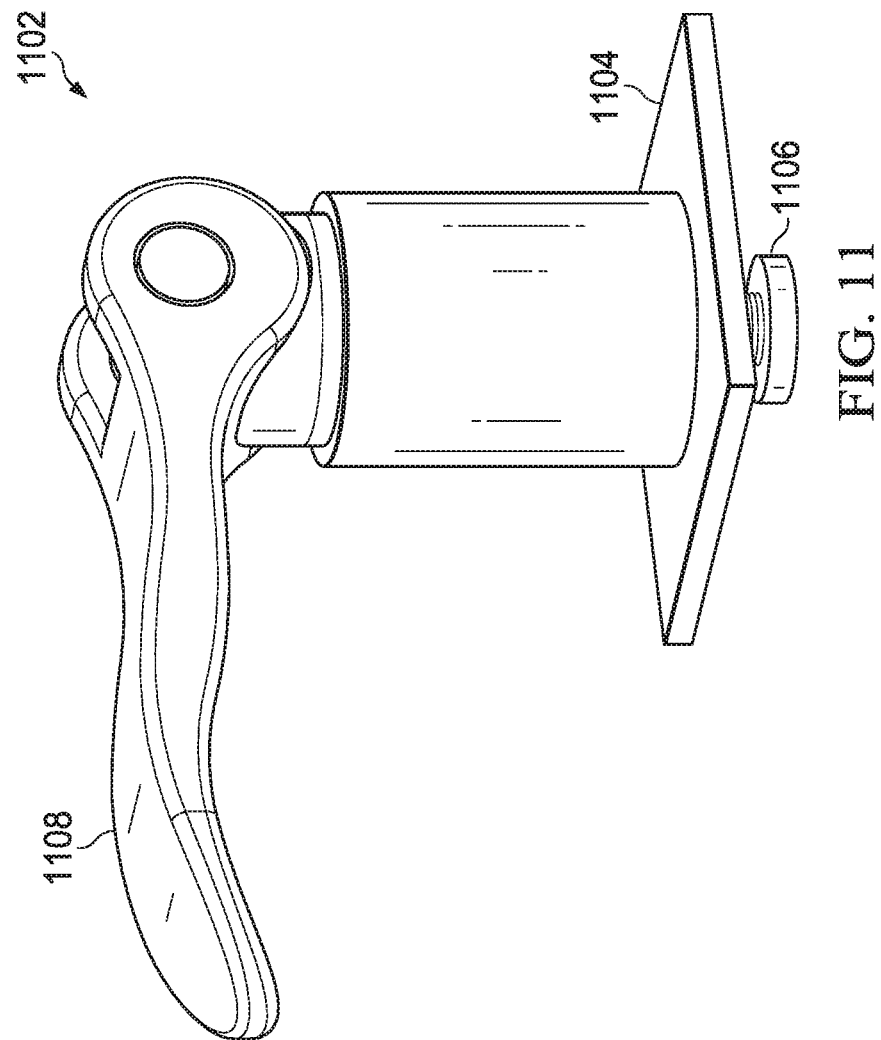


FIG. 10



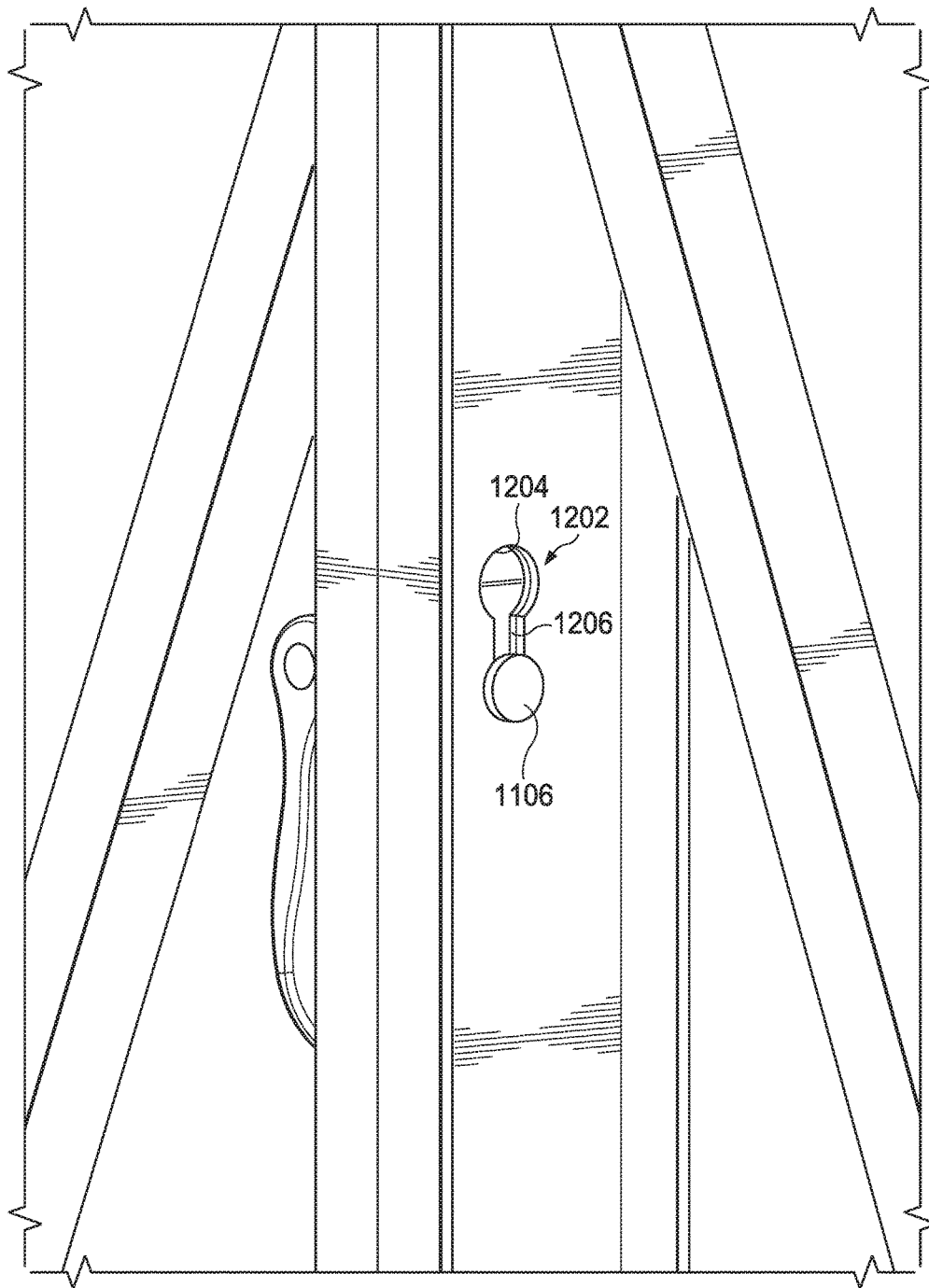


FIG. 12

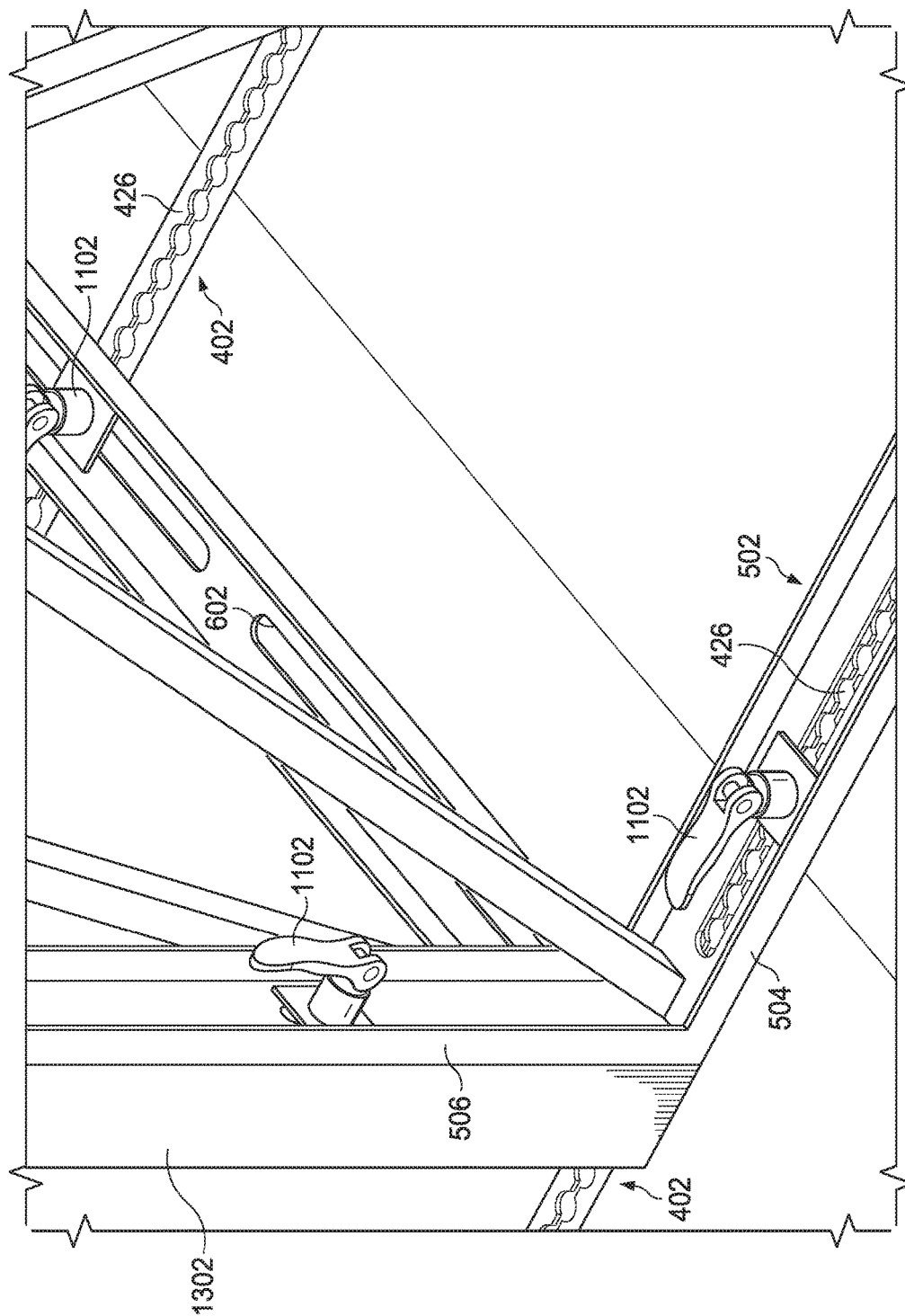


FIG. 13

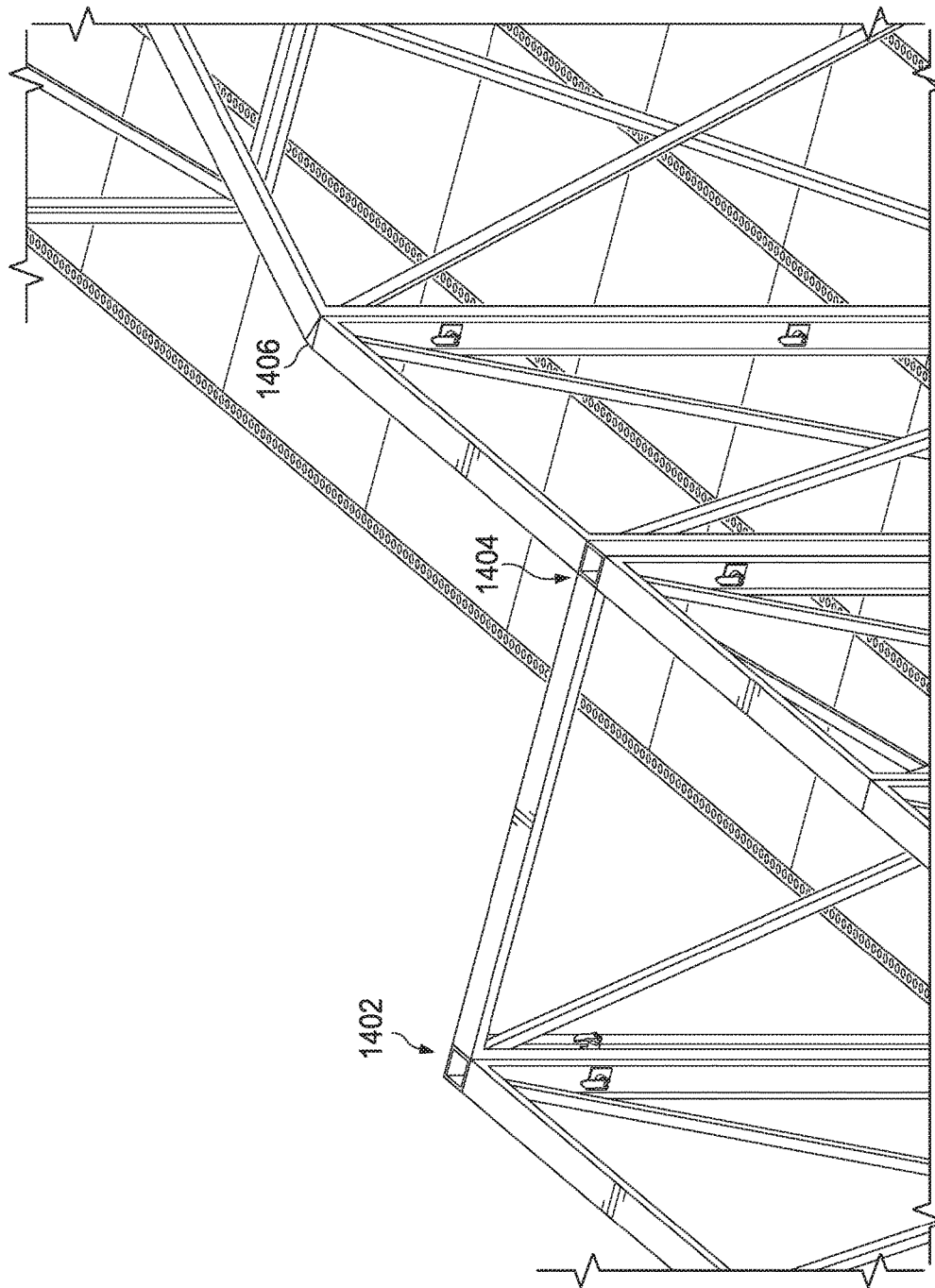


FIG. 14

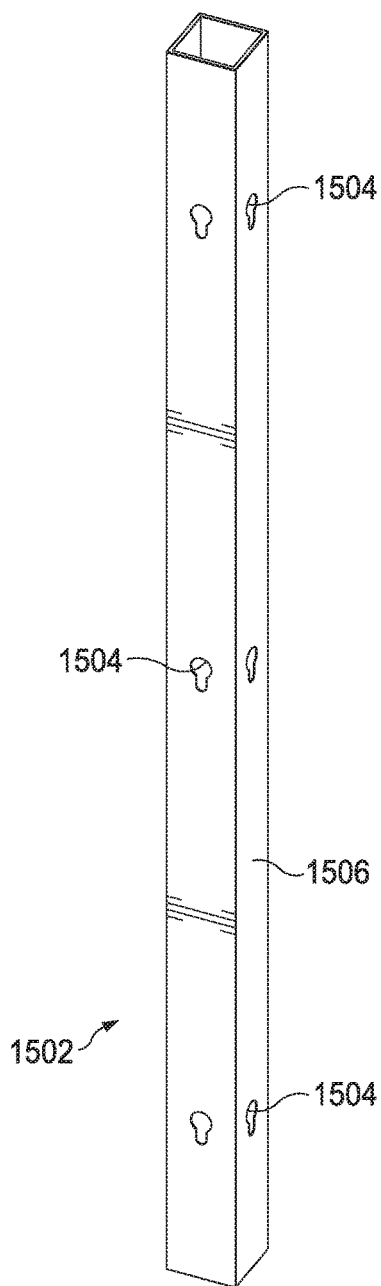


FIG. 15

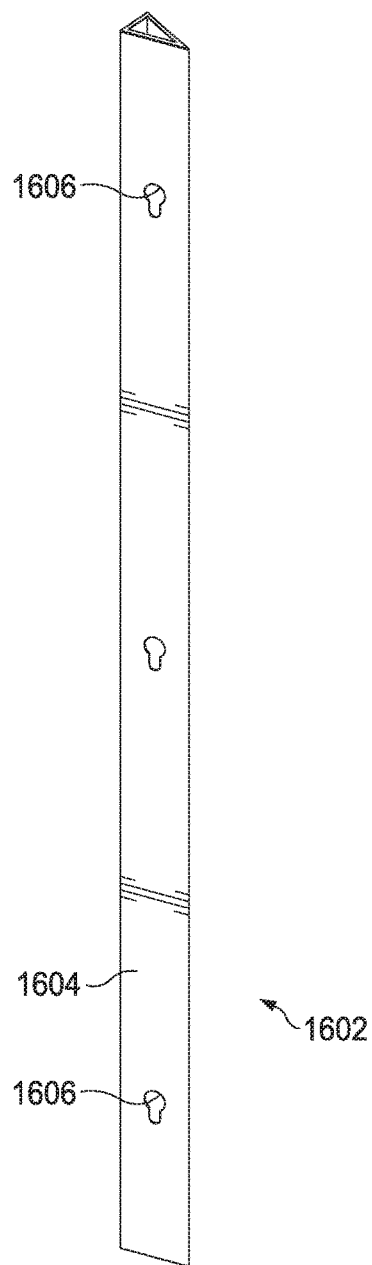


FIG. 16A

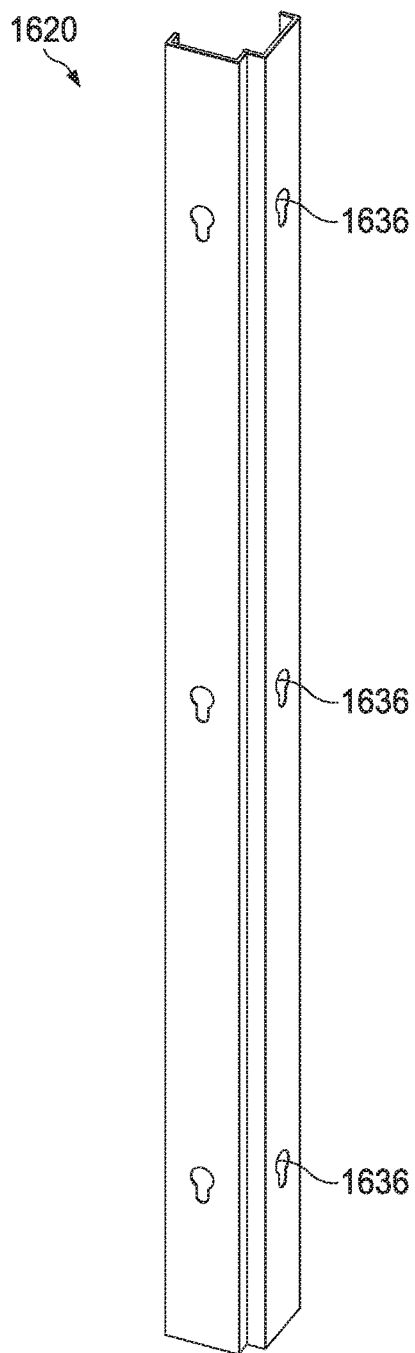


FIG. 16B

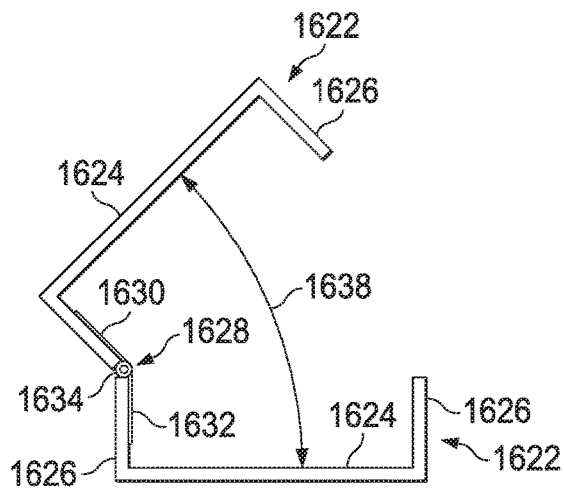


FIG. 16C

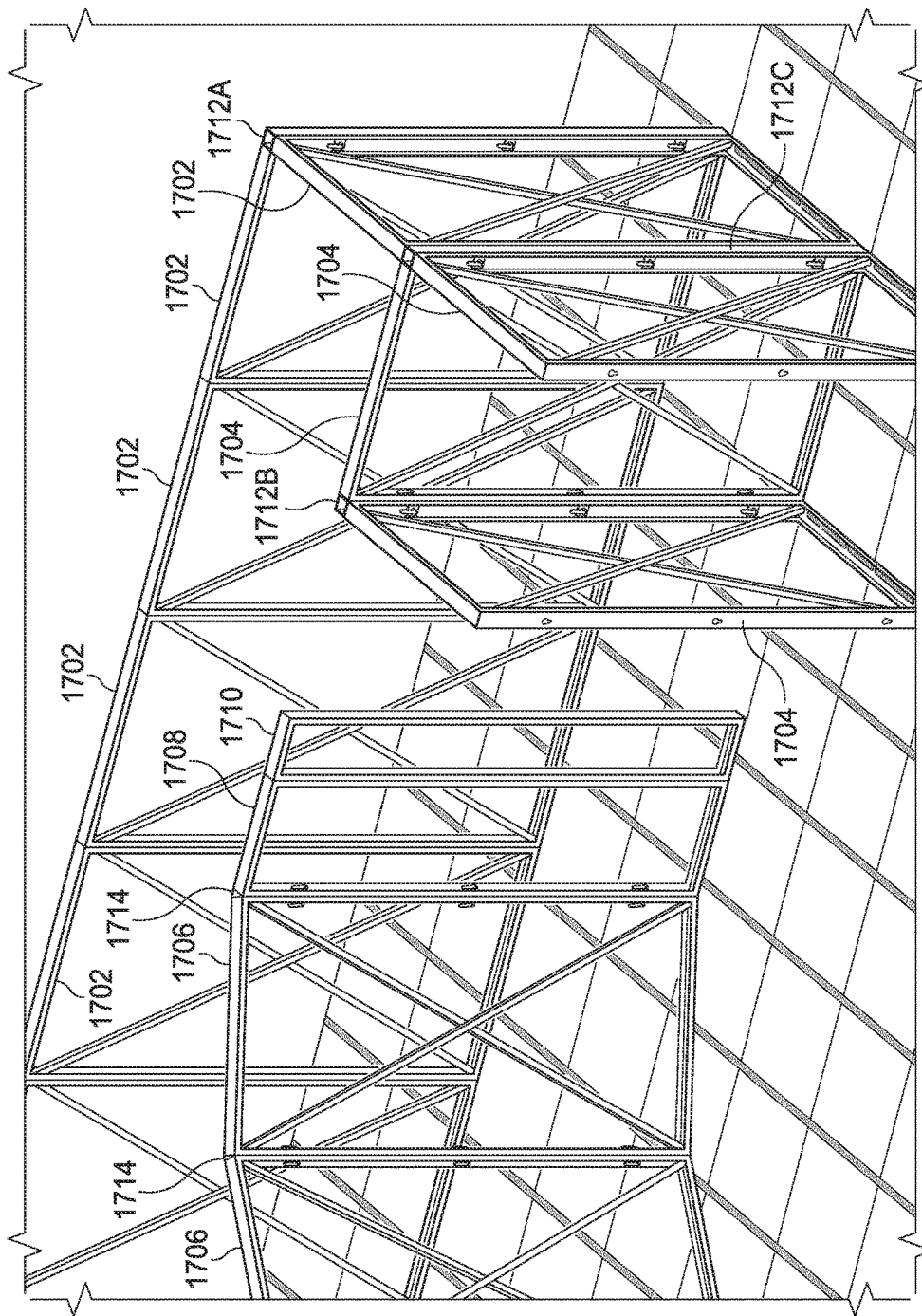


FIG. 17

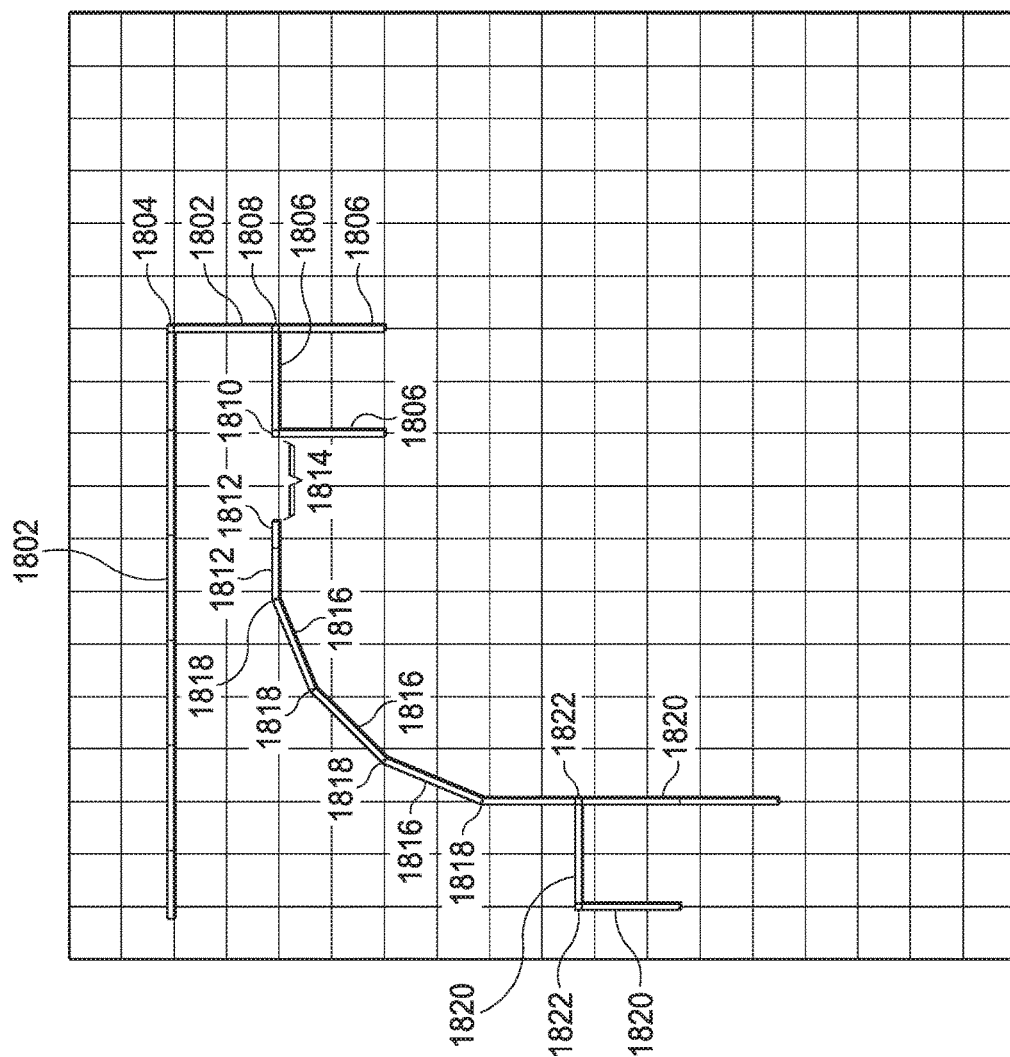


FIG. 18

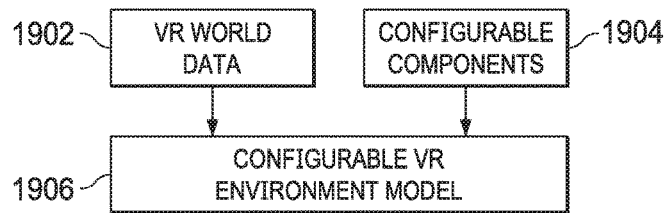


FIG. 19

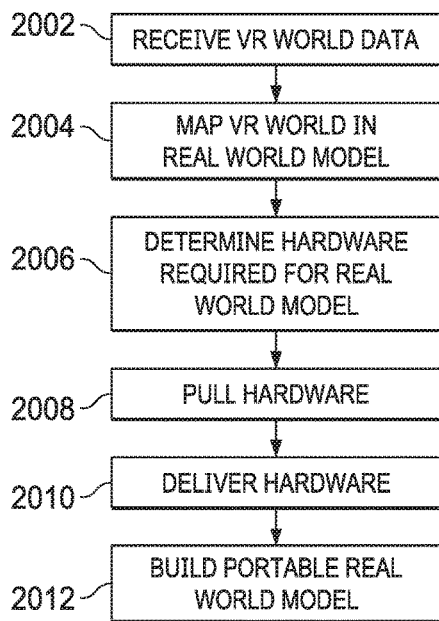


FIG. 20

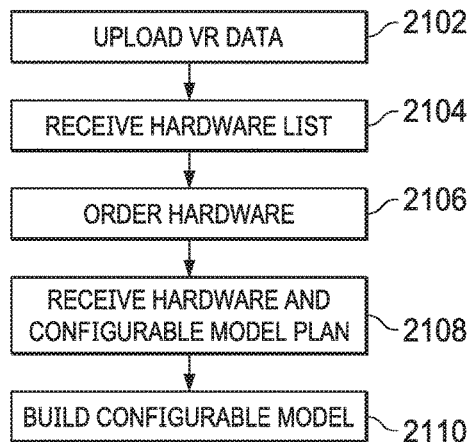


FIG. 21

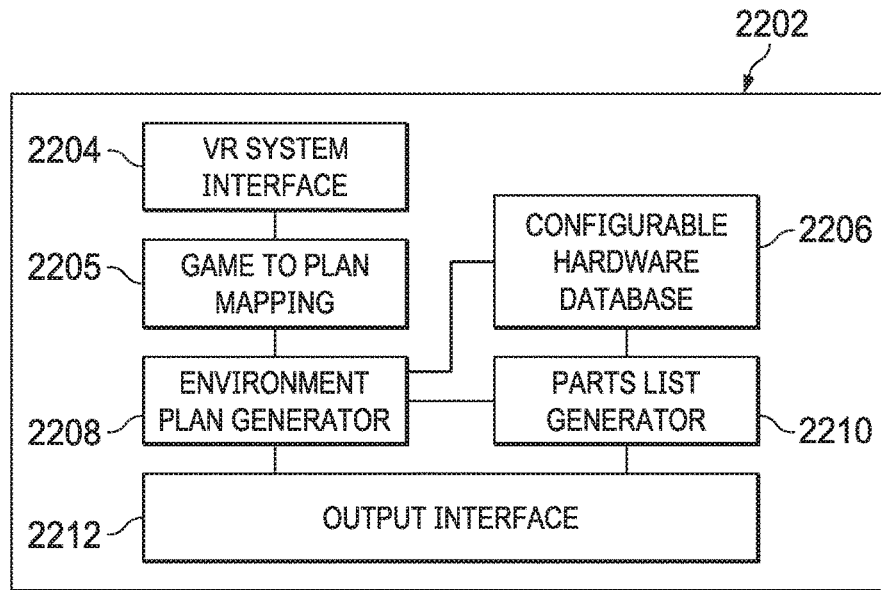


FIG. 22

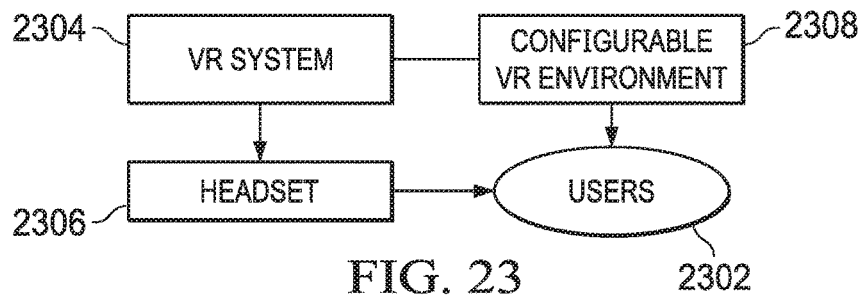


FIG. 23

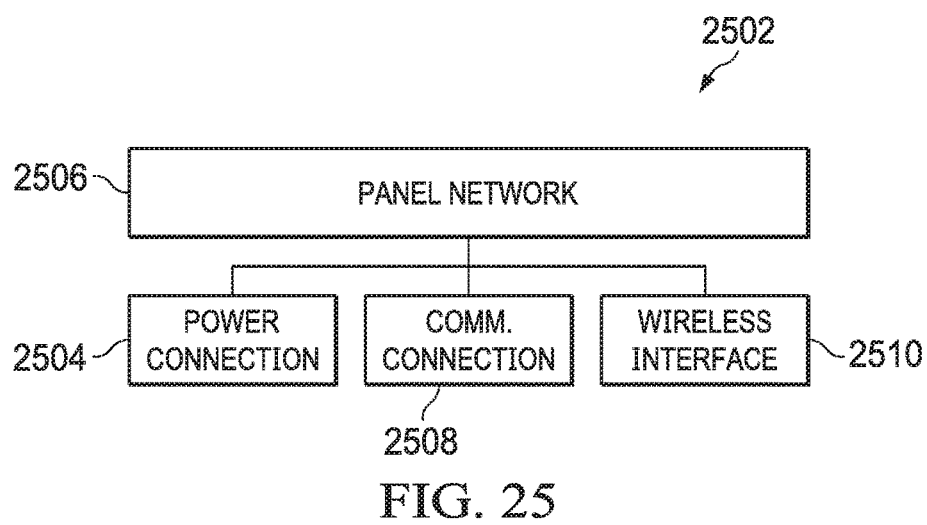
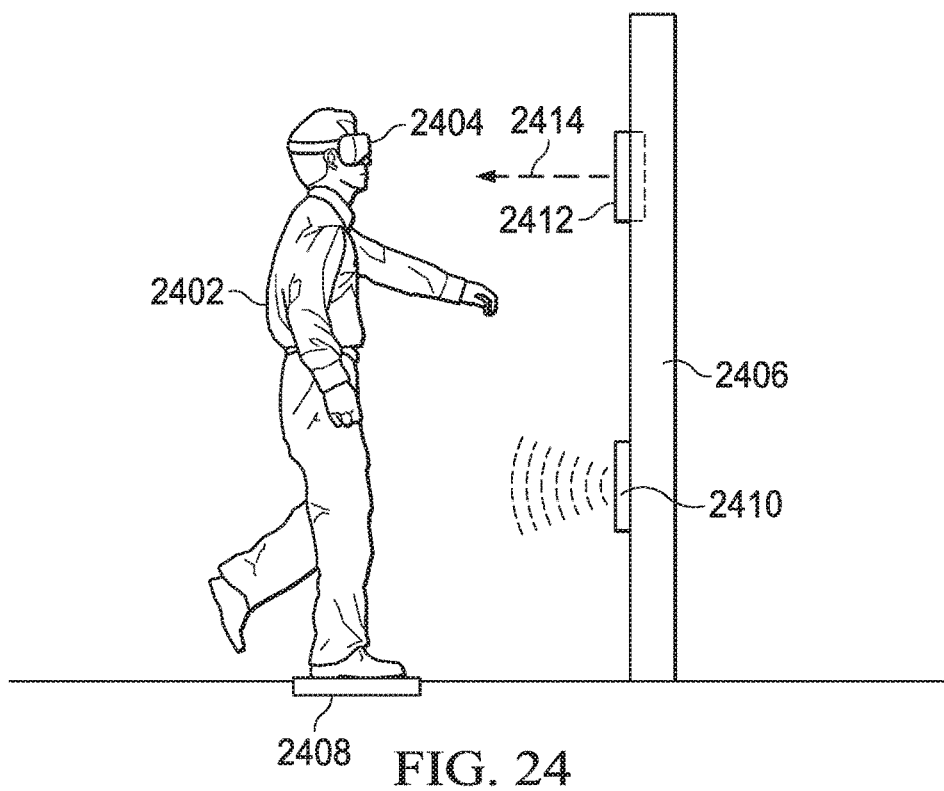


FIG. 27

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SYSTEM AND METHOD FOR HAPTIC MAPPING OF A CONFIGURABLE VIRTUAL REALITY ENVIRONMENT

TECHNICAL FIELD

The present invention relates to virtual reality environments, and more particularly, to a method for providing a configurable virtual reality environment model that a user may interact with in conjunction with a virtual reality environment.

BACKGROUND

Virtual reality systems have been greatly increasing in popularity and usage as the ability to create virtual worlds using computer technologies have developed. Within a virtual reality system, a user wears some type of headset or viewing goggles which project a virtual world for the user to see. Virtual reality systems may find uses in various types of training for soldiers, police officers, firemen, etc. or within an entertainment environment such as a gaming or movie viewing system. Current virtual reality systems normally place the user in a location where the user may freely move about without physically touching anything in the real world other than the floor. Thus, if the user touches a wall or item in the virtual reality world they can see this interaction through their virtual reality (VR) headset but the user does not physically feel anything in the real world.

One manner in which the virtual-reality experience has been improved for users is the use of various types of haptic feedback. Items in a user's hand or mounted to their body may vibrate or shake in order to provide physical feedback similar to what is occurring within the virtual-reality world. Another technique has been the creation of a fixed set within the real world that in its physical configuration mimics the items that are being viewed in the virtual-reality world. Thus, for example, if the user was reaching out to touch a wall in the virtual-reality world, the user would feel a physical wall in the real world that would provide a further input such that the user did not only see themselves touching a wall but actually felt themselves doing so. The problem with creating these type of fixed per minute real world sites are that the system is limited to a single map for operating with the virtual-reality world and the requirements that the physical model be created at a fixed location that requires users to come from other locations in order to experience the VR world in this manner.

SUMMARY

The present invention, as disclosed and described herein, in one aspect thereof comprises a system for providing a virtual reality experience includes a display associated with a field of view of a user. A virtual reality system renders a virtual reality world responsive to a movement of the user and displays the rendered virtual reality world to a user through the display. A configurable virtual reality environment model may be configured to place physical walls in a location that corresponds to a virtual wall located within with virtual reality world such that when the display shows the user touching a wall in the virtual reality world, the user feels the physical wall placed in the configurable virtual reality environment.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding, reference is now made to the following description taken in conjunction with the accompanying Drawings in which:

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FIG. 1 illustrates a user interacting with a haptic feedback steering wheel;

FIG. 2 illustrates a user in a VR headset physically interacting with a wall;

FIG. 3 illustrates a map of a physical room that may be created for a user in a VR world to interact with while interacting in the VR world;

FIG. 4A illustrates a flooring system of a configurable VR environment model;

FIG. 4B illustrates the cross brace and cross brace mounting hole within an I-beam;

FIG. 5 illustrates a wall panel support structure of a configurable VR environment model;

FIG. 6 illustrates a base support of the wall panel of FIG.

5; FIG. 7 illustrates a side support of the wall panel of FIG.

5; FIG. 8 illustrates a wall panel having a surface skin placed over the support structure;

FIG. 9 illustrates a wall panel having particular textures applied thereto;

FIG. 10 illustrates various sized wall panels;

FIG. 11 illustrates a perspective view of a cam-lock clamp;

FIG. 12 illustrates a cam-lock clamp inserted within cam-lock holes in wall panels;

FIG. 13 illustrates the manner in which wall panels and floor panels are interconnected with each other in the configurable VR environment model;

FIG. 14 illustrates various junction connections for wall panels;

FIG. 15 illustrates a 90° support member for interconnecting wall panels;

FIG. 16A illustrates an angled support member for interconnecting wall panels;

FIG. 16B illustrates a perspective view of a hinged vertical support member;

FIG. 16C illustrates an end view of the hinged vertical support member;

FIG. 17 illustrates an example of a configurable VR environment model constructed using wall panels and floor panels;

FIG. 18 illustrates a top view of a configurable VR environment model;

FIG. 19 illustrates the manner in which a configurable VR environment model may be generated;

FIG. 20 illustrates a flow diagram describing the manner for creation of the configurable VR environment model;

FIG. 21 illustrates a flow diagram describing the manner in which a customer would order a configurable VR environment model;

FIG. 22 illustrates a system for generating a plan and parts list for a configurable VR environment model responsive to provided VR world data;

FIG. 23 illustrates the manner in which a VR system and a configurable VR environment model interact with a user;

FIG. 24 illustrates a further embodiment for implementing sensors and physical world interactions with a user in the configurable VR environment model;

FIG. 25 illustrates a wall panel with a control system interface;

FIG. 26 illustrates a wall panel having communications links with other components; and

FIG. 27 illustrates a flooring portion with an associated registration grid.

DETAILED DESCRIPTION

Referring now to the drawings, wherein like reference numbers are used herein to designate like elements through-

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out, the various views and embodiments of a system and method for haptic mapping of a configurable virtual reality environment are illustrated and described, and other possible embodiments are described. The figures are not necessarily drawn to scale, and in some instances the drawings have been exaggerated and/or simplified in places for illustrative purposes only. One of ordinary skill in the art will appreciate the many possible applications and variations based on the following examples of possible embodiments.

Referring now to FIG. 1, there is illustrated a first manner in which virtual-reality worlds have interacted with the real world using haptic feedback. Within a haptic feedback system, a user 102 receives physical feedback from a device that they are in contact with during the virtual-reality experience. In FIG. 1, the user 102 is holding a steering wheel 104. In order to simulate driving an actual vehicle and receive feedback through the steering wheel 104 that simulates driving a vehicle, the steering wheel 104 will shake as shown generally at 106. The shaking movement simulates the feel that a user would receive through a steering wheel 104 of an actual vehicle. The shaking 106 of the steering wheel 104 would be synchronized with events occurring through the virtual-reality (VR) headset 108 such that when a user 102 saw something through the headset 108, they would also feel something related to what they saw through the steering wheel 104.

FIG. 2 illustrates a further manner in which a user 202 interacts with a virtual-reality environment through a headset 204. Normally, within a virtual-reality system, the user 202 sees the virtual-reality world through the headset 204. Within the actual physical world, the user 202 is placed within an open room or area so that the user will not physically touch items in the real world that would conflict with the images being presented to the user in the virtual-reality world through the headset 204. Thus, while the user 202 may see particular events through the headset 204 they do not "feel" the events they are seeing. In order to overcome this shortcoming, virtual-reality systems have been paired with a physical environment in a manner referred to as haptic mapping. Within this environment, physical elements 206 such as walls, windows, tables, doors, etc. are located within a physical area and these physical items are located at a same position as they are presented within the virtual-reality world that the user 202 is viewing through the headset 204. Thus, when the user 202 reaches out with their hand and places their hand on a wall within the virtual-reality world, the user would also feel the actual wall 206 that has been placed within the physical space surrounding the user. Thus, the user 202 would experience a more immersive experience as they would both see and feel the virtual-reality experience. These physical models generated by existing virtual-reality systems are permanently created in fixed locations that require the virtual-reality systems users to experience only a single virtual-reality model because only a single physical environment is available with which the user can interact. Overhead cameras in the physical space allow mapping of the virtual headsets to the physical world.

A more detailed illustration of a configurable VR environment model 302 is illustrated in FIG. 3. A top down view of a configurable VR environment model 302 of a room is illustrated. The room includes four walls 304 enclosing an interior area 306. One wall 304 defines a door 308 enabling entry into and exit from the interior area 306 of the room. Another wall 304 defines a window 310 which would enable the user 314 to feel a window which they were looking out of in the virtual-reality environment. The room configura-

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tion also includes a table or counter 312 within the interior area 306 that may be physically interacted with by virtual-reality users 314 that are moving about the room. Finally, a closet 316 is defined in one corner of the room via another set of walls 318. The closet 316 may be accessed via a second door 320.

Within this configurable VR environment model 302, the users 314 may move about the interior area 306 of the room. The physical structure enables the users 314 to actually touch walls 304 that they see within the VR world, pass through doors 308, 320 seen within the VR world, feel windows 310 that they are looking out of within the VR world and interact with structures such as tables or counters 312 located within the interior of the room. This provides the user 314 with a much more immersive VR experience as they are able to both see the VR world through their VR headset and feel a related item within the physical world.

In order to provide variety to the users 314, the ability to provide a configurable VR environment model 302 is necessary. Otherwise, the users 314 would be required to always play a same physical model that could never be changed. This would limit the entertainment factor in a gaming type environment as the user 314 would become bored with the environment after a certain number of game plays. Within a virtual-reality training environment, it is often necessary to configure an environment to a particular situation for which a group of individuals is training. If the group is only allowed train up on a single fixed physical environment, the benefits of the training are greatly limited. Thus, the ability to provide a varied environment and varied training scenarios will provide much greater training benefits to all individuals involved.

In order to provide the configurable VR environment model, the structures must provide ease of configurability between the model components. Referring now to FIG. 4A, there is illustrated the floor configuration. The floor configuration consists of a plurality of aluminum I-beams 402. The I-beam 402 comprises an I-shaped aluminum member that defines a plurality of holes 404 within the central portion 406. In one embodiment, the holes comprise two inch holes that are separated by 28 inch centers. The holes 404 enable for a wireless chase between sections. Thus, wires necessary for operating electronic components of the VR system and associated configurable VR environment model may run below the floor without interfering with gameplay or training protocols.

Referring now also to FIG. 4B, there is more particularly illustrated the cross brace 410 and associated cross brace slot 408. The cross brace 410 comprises an L-shaped aluminum member that includes a 1/4 inch hole 412 located a distance from the end of the cross brace 410 at the connection axis of the two portions of the L-shaped cross brace. The central portion 406 of the I-beam 402 further defines a cross brace slot 408. The cross brace slot 408 defines a L-shaped opening large enough to receive the L-shaped cross brace 410. The cross brace slot 408 defines a pin 414 extending upward from the bottom angle connection point of the L-shaped slot. When the cross brace 410 is inserted into the cross brace slot 408, the pin 414 engages the hole in the cross brace slot 408. The locking pin 414 engages the hole 412 within the cross brace 410 to maintain the cross brace in a fixed position with respect to the I-beam 402. In one embodiment, the cross braces 410 maintain I-beams 402 at 24 inch centers. When multiple cross braces 410 are located in several places along the length of a pair of I-beams 402, a fixed flooring panel section is established. By tying several

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flooring panel sections together, a configurable VR environment model floor is established.

The I-beam **402** has a base member **416** which rest on the floor. A top member **418** has an aluminum bar **420** welded thereto. In one embodiment the aluminum bar comprises a 1/2 inch by three-quarter inch aluminum bar with the three-quarter inch surface being welded to the top member **418**. An aluminum cargo track **422** is welded to the top surface of the aluminum bar **420**. The aluminum cargo track **422** comprises a rectangular member defining an opening or slot therein along the longitudinal axis thereof. The aluminum cargo track **422** is welded to the top surface of the aluminum bar **420** along the bottom surface of one of the long sides of the rectangular aluminum cargo track. The top surface of the opposite long side of the rectangular aluminum cargo track **422** defines a slot **424** along the length of the cargo track. The slot includes a plurality of cam openings **426**. The cam openings **426** are large enough to receive a cam disk from the cam lock clamp which will be more fully discussed hereinbelow with respect to FIGS. **11** and **12**. The cam openings **426** are set on a 2 inch center. This enables a high level of precision and granularity when placing wall panels to create configurable VR environment models on the floor sections. Once inserted through the cam openings **426**, a cam disk may be moved to a narrow portion of the slot between the openings to clamp an item in place.

Flooring within the floor sections consists of one inch plywood decking **428** that is laid on top of an edge of the top members **418** of the I-beams **402** between the aluminum cargo tracks **422**. The thickness of the plywood decking **428** is such that the top surface of the plywood decking will be level with the top surface of the aluminum cargo track **422**. While the discussed embodiment describes the use of plywood decking **428**, other types of decking material may be utilized for the flooring as long as the material is strong enough to support the weight of individuals walking on the decking surface and light enough to enable the reconfiguration of the floor paneling by a single individual.

Once the flooring sections are established within the configurable VR environment model, various wall panels may be configured on the flooring surface. Referring now to FIG. **5**, there is illustrated a wall panel **502**. Each wall panel **502** consists of a base member **504**, two side members **506**, a top member **508** and cross braces **510**. The base member **504**, shown also in FIG. **6**, is a C-shaped aluminum beam including a base portion **604** and two side portions **606**. The base portion **604** defines a plurality of elliptical slots **602**. The elliptical slots **602** enable the base member **504** to be moved to a variety of positions along the longitudinal axis **608** of the C-shaped aluminum beam. The base member **504**, side members **506** and top member **508** are welded together at their ends to form a rectangularly shaped wall panel **502** and the ends of cross braces **510** are welded to opposite corners of the rectangle in order to provide angular support to the wall panel structure.

Each wall panel **502** includes a pair of side members **506** that also comprise C-shaped aluminum beams as shown in FIG. **7**. As with the base member **504**, each side member **506** includes a base portion **702** and two side portions **704** within the C-shaped aluminum beam. The base portion **702** further defines a number of connecting slots **706** for interconnecting the wall panels **502** with adjacent wall panels or other types of vertical supporting members. The slots **706** are configured to receive a cam disk of the cam block clamp (see FIG. **11**) and include an opening for inserting a cam disk and slot for receiving the cam shaft. The embodiment shown in FIGS. **5** and **7** include three connecting slots **706** for interconnecting

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the wall panels **502**, but one skilled in the art will appreciate that additional, or fewer, slots may be utilized for interconnecting the wall panel with adjacent structures. The connecting slots **706** will be at a consistent placement with respect to adjacent wall panels **502** such that a cam lock clamp may be placed through aligned connecting slots **706** of adjacent side members **506** to enable connections therebetween.

Once the structural frame of the wall panels **502** have been created, covering panels **802** are connected to each side of the wall panel over the wall panel frame defined by the base member **504**, side members **506**, top member **508** and cross braces **510**. The covering panel **802** defines a number of openings **804** therein. The openings **804** along the side members **506** enable for movement and positioning of the wall panel **502** when it is being moved between locations or positioned into a configurable VR environment model. An opening **804** along the bottom of the wall panel **502** near the base member **504** is used for similar purposes. The covering panels **802** additionally include a plurality of holes **806** therein forming a grid across the entire surface of the covering panel **802**. The holes **806** are separated on a 1/4 inch up to any size centers that will fit within the covering panel **802**. The covering panels **802** are connected to the wall panel frame via connectors **805**. The plurality of holes **806** enable various textures and items to be connected to the wall panel **502** or formed as an integral part thereof. Thus, by utilizing pegs on the backside of an item, the pegs may be inserted through the holes on the covering surface **802** to enable the item to be affixed to the wall. The material affixed to the wall may comprise textures such as a rock or wood wall, a window or other type of opening outline, or may be used for providing a shelf, mantle for a fireplace or any other texture which would need to be simulated within the real world to provide tactile feedback to a user in the VR world consistent with what they are viewing in the virtual world.

Referring now to FIG. **9**, there is illustrated the manner in which textures may be inserted into the covering panel **802** using the plurality of holes **806** on the surface thereof. In FIG. **9**, a window **902** has been created on the wall panel **502**. The window **902** consists of a rectangular frame structure and cross pieces for creating a model of a window frame. Additionally, a shelf **904** has been inserted into the wall panel **502** to provide a surface below the window which may be touched or have items placed there on. The shelf **904** could additionally have items **906** placed there on that a user may interact with but the items **906** would need to be placed within a specific registered location of on the shelf **904** such that the item can be specifically located within the VR world being presented to the user through their VR headset. The item **906** could be registered by being placed within a specific location on the shelf **904** or alternatively, could include some type of transmitting device that enabled the system to determine a position of the item when it moves within the VR world in much the same manner that position of individuals interacting with the VR world have their position tracked.

The wall panels **502** may be constructed in a variety of sizes in order to accommodate differing virtual-reality environment models as shown in FIG. **10**. Wall panels **502** may be 3"x45"x96" **1002**; 3"x22.5"x96" **1004**; 3"x12"x96" **1006** or any other applicable size. Each of the wall panels **1002**, **1004** and **1006** comprises the panel frame **1008** covered by a pair of panel coverings **1010**. The covering panels **1010** comprise vacuum formed textured panels that may be quickly changed using panel quick connect fasteners **1012** to provide differing wall surface textures to suit various con-

figurable VR environment models. The varying size wall panels enable the modeling of a variety of different configurable VR environment models for use with differing types of VR worlds.

While the above descriptions have envisioned a wall panel 502 including rigid base members 504, side members 506 and top members 508, the wall panel may also be constructed using flexible members that may be temporarily or permanently bent to a curved position. In this manner, the base member 504 and top member 508 could be curved to represent a curved representation in the configurable VR environment model such as a column, tree trunk or other curved surface. Additionally, the side members may also be flexibly bent in the vertical axis to create a curving surface such as a dome or archway rising above or away from the user in the virtual-reality environment. In this manner, curved surfaces may also be created in the configurable virtual-reality environment model rather than just being limited to planar surfaces. Alternatively, some or all of the base member 504, top member 508 and side members 506 may be constructed from rigid curved members to provide the same curved infrastructure in a more permanent form.

The wall panels 502 and I-beams 402 of the floor unit are interconnected using connecting clamps. Referring now to FIG. 11, there is an example of a particular embodiment of a clamp comprising a cam-lock clamp 1102. The cam-lock clamp 1102 comprises a base plate 1104 and a cam-lock disk 1106 located on a bottom side of the base plate 1104. The cam-lock disk 1106 fits through openings in for example the aluminum aircraft cargo track 422 of the I-beam 402 and the side members 506 of the wall panels 502. After being inserted through the openings, the cam-lock disk 1106 may be locked down on surfaces located between the cam-lock disk and the base plate 1104. The cam-lock disk 1106 is locked in place using a lever 1108. In the unlocked or raised position the lever 1108 surfaces may move freely between cam-lock disk 1106 and the base plate 1104. When the lever 1108 is in the locked or lowered position, the cam-lock disk 1106 and base plate 1104 will securely clamp to any surface located between the cam-lock disk and the base plate.

The manner of use of the cam-lock clamp 1102 is more fully illustrated in FIG. 12, wherein there is illustrated a cam-lock clamp 1102 inserted through locking holes 1202 of a wall panel. The locking hole 1202 includes a cam hole 1204 and slot 1206. The cam-disk 1106 of the cam-lock clamp 1102 is inserted through the cam holes 1204 of the wall panels and is lowered into the slot 1206 while the lever 1108 is in the open or unlocked position. After the clamp 1102 is moved into the slot 1206, the lever 1108 is moved to the locking position. This causes the cam disk 1106 to clamp together with the base plate 1108 and secure the side members of the wall panels together.

Referring now to FIG. 13, the wall panels 502 and I-beams 402 may be interconnected with each other utilizing the cam-lock clamps 1102. The wall panels 502 are connected to the I-beams 402 by placing the slots 602 of the base member 504 of the wall panel over a particular cam opening 426 within the cargo track 422 of the I-beam 402. As discussed previously, the cam openings 426 are separated by two inch centers. This enables the wall panels 502 to be positioned in two-inch increments enabling a high level of precision in the wall panel placement. When the wall panel 502 is located in a desired location and the slot 602 is aligned with one of the cam openings 426, a cam-lock clamp 1102 is placed such that the cam-lock disk 1106 inserts through one of the cam-lock holes 426. The lever 1108 of the cam block clamp 1102 may then be moved to a lock position in

a narrower portion of the cargo track 422 to clamp the base member 504 of the wall panel 502 to the floor. The base plate 1104 of the cam-lock clamp 1102 and the cam disk 1106 clamp the base member in the cargo track 422 between them to securely fasten the wall panel member 502 to the floor. The two inch centers of the cam openings 426 enable the wall panels 502 to be placed in horizontal, vertical and angled orientations with respect to the cargo tracks 422 and provide a variety of levels of configurability of the wall panels. The combination of the openings 426 within the cargo tracks 422 and the slots 602 of the base members 504 allow for a great deal of movement flexibility in the placement of the wall panels 502. The large number of openings 426 within the floor cargo tracks 422 allow the placement of the wall panels 502 at a large number of locations and in a variety of orientations with respect to the tracks. The slots 602 allow for a large degree of movement along the axis 602 of the base member to allow the wall panel placement to be finely tuned to meet the requirements of the configurable VR environment model.

The side members 506 of the wall panel 502 may interconnect with other wall panels or vertical support members 1302 as will be more fully described hereinbelow. The side members 506 interconnect with other wall panels 502 or vertical support members 1302 using the cam-lock clamps 1102. With the lever 1108 in the unlocked position, the cam-lock disk 1106 is located in a position that will pass through the openings 804 within the side members 506 or vertical support members 1302. The cam-lock member 1106 may then be moved to a position that will not pass through the opening 804 and the lever 1108 is moved to the locking position. This locks the side members 506's or vertical support member 1302 between the base plate 1104 and cam-lock member 1106 to help maintain the wall panel 502 in an upright position.

Referring now to FIG. 14, there is provided more detailed information regarding the manner for interconnecting side members 506 of wall panels 502. FIG. 14 illustrates a number of interconnected wall panels 502 in a 90° connection 1402, a T-Junction connection 1404 and an angled connection 1406. The 90° connection 1402 and T-junction connections 1404 are achieved using a vertical support member 1502 as shown in FIG. 15. The vertical support member 1502 comprises a rectangular member 1506 made from aluminum tubing. Each of the four sides of the rectangular member 1506 defines multiple cam openings 1504 therein for receiving the cam disk 1106 of the cam-lock clamp 1102. The rectangular member 1506 may have a side member 506 of a wall panel 502 clamp thereto using cam-lock clamp 1102. The openings 1504 of the rectangular member 1506 are positioned to align with corresponding openings 706 of the side members 506 of the wall panel 502. Thus, by inserting the cam disk 1106 through the aligned holes 706 and 1504 placing the lever 1108 in the locking position, multiple cam-lock clamps 1102 may be used to secure wall panels 502 in a 90° connection 1402.

In a similar manner, a T-junction connection 1404 may be achieved using the vertical support member 1502. In the case of a T-junction connection 1404, the rectangular member 1506 has wall panels 502 connected to three sides thereof. As before, the holes 1504 within the vertical support member 1502 are aligned with corresponding openings 706 of a side member 506 of a wall panel 502. A cam-lock clamp 1102 is inserted through the aligned holes and locked into place to lock the wall panel in an upright position. In a similar manner to that described with respect to the T-Junction connection 1404, wall panels 502 could also be con-

nected to each side of the vertical support member **1502** to provide a four wall panel intersection connection if needed.

An angled connection **1406** utilizes an angled vertical support member **1602** as illustrated in FIG. **16A**. The angled vertical support member **1602** comprises a triangular member **1604** including three sides. Either two of the sides, or all three of the sides define openings **1606** therein. Each of the openings **1606** align with a similar opening **504** within the side member **1506** of the wall panel **502**. A cam-lock clamp **1102** is inserted through the aligned holes and the lever moved to the lock position to secure the wall panel **502** with the angled vertical support member **1506**. The angle provided by the angled connection **1406** of FIG. **14** comprises a 22.5° angle connection. However, angles of various other degrees may also be implemented within the angled vertical support member **1506** that are consistent with the two inch centers provided by the I-beams.

Referring now to FIGS. **16B** and **16C** there is illustrated a further manner for interconnecting wall panels **502** together. Rather than directly connecting the side members **506** together or connecting the side member to a vertical support member **1502** or angled vertical support member **1602**, a hinged vertical support member **1620** may be utilized. The hinged vertical support member **1620** comprises first and second U-shaped aluminum members **1622** having a base portion **1624** and two side portions **1626** extending perpendicularly from each edge of the base portion. The U-shaped aluminum members **1622** are interconnected by a hinge mechanism **1628**. The hinge mechanism **1628** comprises a first plate **1630** that connects to a side portion **1626** of a first U-shaped aluminum member **1622** and a second plate **1632** that connects to a side portion of a second U-shaped aluminum member. The first plate **1630** and second plate **1632** are connected at a rotating connection **1634**.

The base portion **1624** of the U-shaped aluminum members **1622** defines a plurality of connection holes **1636** therein. The connection holes **1636** comprise the hole and slot configuration as described above with respect to the wall panel side members **506** that are placed and sized to align with the corresponding connection holes located on the side members **506** of a wall panel **502** or the vertical support members. The connection holes **1636** on the U-shaped aluminum members **1622** are aligned with the corresponding connection holes on the side panel **502** or vertical support members and interconnected with each other using a clamping mechanism **1102**. Once connected, the wall panel may be moved along an axis **1638** to be placed at any desired angle between 0° and 90°. While FIGS. **16B** and **16C** have illustrated the use of a single hinge mechanism **1624**, in alternative embodiments a separate smaller hinge mechanism may be separately located on the U-shaped aluminum members **1622** rather than using a single hinge mechanism.

Using the above described components for designing a configurable VR environment model, a structure such as that provided in FIG. **17** may be provided. A structure comprising a plurality of full-size wall panels **1702** is provided that creates an exterior wall. A small closet area is defined by panels **1704**. An interior wall is provided by a pair of full-size panels **1706** and a 22 and a half-inch panel **1708** and 12 inch panel **1710**. Support members provide for both 90° corner connections at **1712A** and **1712B** and a T-junction at **1712C**. Finally, 22.5° angle corners are provided at angled vertical connectors **1714**. The angled corners allow for a more gradual change in direction of the wall. Once the

wall panels have been erected, the coverings may be placed over the support structures in order to provide the desired wall textures.

FIG. **18** provides a top-down view of the structure created in FIG. **17**. The exterior walls **1802** are created by a series of interconnected wall panels that are connected at a 90° connection using a vertical support member at point **1804**. A small closet is created by panels **1806** provided via a T-junction using a vertical connection member at point **1808** and a 90° connection using a vertical support member at point **1810**. Panels **1812** comprise smaller size wall panels as described hereinabove to provide the door opening **1814**. A curved wall structure is provided using a series of wall panels **1816**. The panels forming the curve are interconnected via angled vertical supports at points **1818**. The angled vertical supports provide a 22.5° angle between adjacent panels to provide the slowly curving/angled surface. Utilizing the slots within the base members of these wall panels and the holes within the track of the I-beams of the floor, the wall panels **1816** may be placed in a desired fashion to provide the curving wall structure. Finally, an additional closet structure is provided using panels **1820** that are interconnected via vertical connection members at points **1822**.

The configurable VR environment model illustrated with respect to FIGS. **17** and **18** has the advantages of being quickly built, broken down and reconfigured by a single individual. The quick release clamping mechanisms and aluminum support structure enable the components to be easily moved by the single individual without requiring the use of large crews for building, breakdown and reconfiguration. Additionally, the design of the components does not require the use of any specialized tools for building the configurable VR environment model. The flooring sections comprised of the I-beams **402**, cross braces **410** and panels **428** may be put together by hand without the need for any specialized tooling. The wall panels **502** and vertical support members may be placed and interconnected with each other using only the panels, vertical support members and clamping mechanisms. This ease of building and reconfigurability by a single individual without requirements of specialized allow for the creation of a variety of configurable VR environment models that enable the VR system to be utilized in a variety of gaming and training environments that are ever-changing and deliverable to a variety of locations.

The configurable components described hereinabove provide a number of benefits to enable the creation of a configurable virtual-reality environment that when paired with a virtual-reality system that displays a virtual-reality environment to a user through a VR headset provide a much more immersive user experience due to the ability to view the virtual-reality world through the headset and feel the virtual-reality world through the configurable VR environment model. The creation of the configurable VR environment model may be achieved as generally shown in FIG. **19**. VR world data **1902** describing things such as locations of walls, doors, windows and other physical structures within a VR world may be paired with information regarding the configurable components **1904**, such as wall panel, floor I-beam, vertical support structures, etc. described hereinabove to enable the generation of the configurable VR environment model **1906**. Upon generation of the model **1906** items such as a parts list of the configurable components **1904** may be created in order to build the environment model for use by individuals.

Referring now to FIG. **20**, there is illustrated a flow diagram of a process for creating the configurable VR

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environment model using the system described herein. Initially, at step **2002** data relating to the VR world to be modeled is received. This information may be physically delivered to a location that provides the configurable VR environment model components or this information could be downloaded via a website or some other type of network connection. This data comprises information defining the physical structures within the VR world that may have physical components modeled therefore using the described configurable components. The received VR world data is used to map at step **2004** a real world model that represents the VR world components that would be displayed to a user through a VR headset. The hardware necessary to create the real world model is determined at step **2006**. This process would involve the determination of the wall panels **502**, I-beams **402**, vertical support members **1502**, angled vertical support members **1602** and wall panel coverings **1010** necessary for building the configurable VR environment model that has been generated responsive to the provided VR data. The determined hardware components are pulled at step **2008** to enable the building of the configurable VR environment model. The pulled hardware and instructions for building the generated configurable VR environment model are delivered to a location in which the VR system and model are to be configured. This can comprise a business location, remote location or any other physical site having sufficient area for setting up the configurable VR environment model. The configurable real world environment model is built at step **2012** to provide the physical aspect to the virtual-reality world environment presented to users through, for example, some type of VR headset.

FIG. **21** is a flow diagram describing the process from the viewpoint of a customer that would be ordering the configurable VR environment model for installation at a location of their choosing. The customer initially uploads their virtual-reality data describing the world they wish to create a physical model for at step **2102**. Responsive to the provided VR data using the procedure more fully described respect to FIG. **20**, the information necessary to generate the configurable VR environment model is generated and provided back to the customer such that the hardware list and associated instructions for the model are received by the customer at step **2104**. The customer reviews the list and model and if desiring to continue, proceeds to order the necessary hardware for building the configurable VR model at step **2106**. The customer receives the can hardware and configurable model plan at step **2108** responsive to their order that enables them to build the configurable VR environment model at step **2110** in accordance with the provided plan using the provided hardware components.

Referring now to FIG. **22**, there is illustrated a functional block diagram of a system for generating a VR environment model plan and parts list in accordance with the system described hereinabove with respect to FIGS. **20** and **21**. The VR environment model plan generation system **2202** includes a VR system interface **2204** that provides a connection to receive virtual-reality world implementation data from a VR system. This data would provide information relating to structures such as walls, doors, windows, etc. within the virtual-reality world for which a configurable VR environment model must be created. The VR data downloaded from the VR system is mapped from the virtual reality word to the real world using the Game to Plan Mapping functionality **2205**. The Game to Plan Mapping functionality takes the VR world information and maps it to an implementation in the physical world. Thus the mapping functionality would determine that a physical wall was

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located at a particular point, that a door was located a predetermined distance from one end of the wall, that a second wall is located a predetermined number of feet from this wall, ect. The mapping functionality **2205** would generate sufficient indexing and reference points between all of the structures within the VR world such that the same structures can be described within the physical world. This process can be accomplished for any gaming environment, VR or otherwise. A configurable hardware database **2206** provides data with respect to all of the available components for building a configurable VR environment model. The database **2206** would include information on the wall panels, I-beams, sensors, tactile feedback devices and other type of components which are available for use in the building of the configurable VR environment model. Various ones of these components have been discussed hereinabove, however it should be realized that other types of components may be utilized.

A configurable VR environment plan generator **2208** utilizes information provided from the Game to Plan Mapping functionality relating to the physical mapping of the virtual-reality environment to the physical world and the available hardware components from the configurable hardware database **2206** to generate a plan for a configurable virtual-reality environment model. The plan would illustrate the placement of floor section components, wall panels, vertical member supports, angled vertical supports and other physical components that provide a physical model of the virtual-reality world illustrated in the virtual-reality data that has been provided. The plan will illustrate the placement of these real-world components such that user may receive tactile response when touching a wall that has been placed in a physical location to correspond to a wall projected to the user through the virtual-reality system. The plan would designate the particular components to be utilized in constructing the model and illustrate their placement with respect to other components in the model. This would enable an individual to easily construct the designated configurable VR environment model.

The parts list generator **2210** utilizes information from the generated VR environment plan provided by the environment plan generator **2208** and the available hardware components from the database **2206** to generate a complete parts list. The parts list would comprise a list of wall panels and their associated sizes, the number of I-beams and cross braces, the number of panel coverings of particular textures and other available components that would be necessary for constructing the configurable virtual-reality environment model according to the plan generated by the plan generator **2208**. The parts list would list the number of items grouped by type and provide the necessary number of components for implementing the plan. The parts list provided by the parts list generator **2210** enables an individual constructing a configurable VR environment model to confirm that they had the components necessary for constructing the model, or enable the company providing the components to have a list to work from for pulling the hardware that is to be provided to a customer for the construction of a particular VR environment model. The model plan generated by the environment plan generator **2208** in the parts list generator **2210** may be provided for use by an individual through an output interface **2212**. The output interface **2212** may connect to a display, printer, network connection, etc. depending upon the manner in which the data that has been generated is to be utilized.

Referring now to FIG. **23**, there is illustrated the manner in which the above systems interact with each other to

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provide a more immersive virtual-reality experience to users **2302**. A VR system **2304** generates a VR world that is projected as images to a headset **2306**. The visual VR world projected to the headset **2306** from the VR system **2304** enables the user **2302** to visually discern the virtual-reality world elements that are being projected into the headset. Combined with the visual data provided to the user **2302** through the headset **2306**, the configurable VR environment model **2308** may be interacted with by the user **2302**. The configurable VR environment model **2308** allows the user **2302** to physically touch the structures that are visually discerned within the headset **2306** to provide a more immersive virtual-reality experience. The configurable VR environment model **2308** is constructed based upon data provided from the VR system **2304** that enables the placement of the physical structures in a manner that will correspond with the user interactions within the virtual-reality world displayed within the headset **2306**. Thus, the user can both touch and see the virtual-reality world that is being experienced.

In addition to providing the physical structures such as floors, walls, doors and windows that a user may tactilely interact with in the configurable VR environment model, further feedback may be provided to a user using a combination of sensors and physical feedback as shown in FIG. 24. A user **2402** wearing a virtual-reality headset **2404** approaches a structure of the configurable VR environment model such as a wall **2406**. Sensors detect the user **2402** as they approach the **2406**. The sensors may take the form of a floor mounted pressure sensor **2408** that is actuated when a user physically stands upon the pressure sensor or, alternatively, a proximity sensor **2410** may detect the presence of the user **2402** as they approach a structure such as a wall **2406**. The proximity sensor **2410** may utilize RF or optical feedback signals for detecting the presence of the user **2402**. The pressure sensor **2408** or proximity sensor **2410** upon detection of an approaching user **2402** provides an actuation signal to an environmental feedback device **2412**. Upon receipt of the actuation signal, the environmental feedback device **2412** will provide an environmental output **2414** that interacts with the user **2402**. The environmental feedback device **2412** may comprise any number of devices such as a fan for blowing air on the user **2402**, a heat lamp for projecting heat waves toward the user, a spray bottle for squirting a liquid on the user or any other similar type devices.

In this manner, the user **2402** is able to experience a simulated environmental interaction caused by approaching a particular structure. Thus, if the user **2402** was approaching a window the sensors **2408**, **2410** could detect the user's presence and turn on a fan that blows air on the user simulating a breeze coming through the window. Alternatively, if the user were approaching a fire in the VR world, the sensors **2408**, **2410** connecting the proximity of the user could turn on a heat lamp to cause the user to experience the heat from the fire. Similarly, the spray bottle could be used for spraying water on a user who was near an opening during a rainstorm or running water that might splash onto the user based upon their position within the virtual-reality world. The combination of sensors and environmental feedback devices **2412** further improve the immersive experience of the user within the virtual-reality. The sensors **2408**, **2410** may also be used to control the environmental feedback devices **2412** to provide other types of feedback such as making a wall panel feel warm or cold to the touch to better reflect the information being provided through the VR headset **2404**.

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The individual wall panels **502**, as described hereinabove, may be configured to include sensors and other environmental feedback components to provide an improved virtual-reality experience to the user interacting with a wall panels. As shown in FIG. 25, each of the wall panels **502** can include an interface **2502** enabling interconnect ability of the wall panel with a centralized control system. A power connection **2504** provides a standard power connection to provide electrical power to all electrical and electronic components interconnected with a panel network **2506**. The power connection **2504** may be used to provide power to sensors **2410** or environmental feedback components **2412** such as those described with respect to FIG. 24 that are implemented within the wall panel **502**. The interface **2502** may further include a communications interface **2508** that allows for wired connection to a standard communications interface such as an RJ-45 connector such that electronic components within panel network **2506** of the wall panel **502** may be addressed from an external controller through the communications interface. In addition to, or alternatively a wireless interface **2510** may be utilized to provide communications between the panel network **2506** and an external system controller. The wireless interface **2510** may implement any wireless communications protocol such as Wi-Fi.

Referring now also to FIG. 26, there is illustrated the manner in which a central controller **2602** may have individual communication links **2604** with wall panels **502**. Each of the wall panels **502** would include one or more Internet accessible components **2606**. These Internet accessible components **2606** could comprise individual devices such as sensors or environmental feedback devices such as those described earlier or some type of central control device associated with the panel network **2506** implemented on a particular panel **502**. This would provide an Internet of things (IOT) type of communication between the central controller **2602** and the Internet accessible devices **2606**. The communication links **2604** may comprise either wired or wireless communication links between the central controller **2602** and the Internet capable devices **2606**. This configuration enables the central controller **26** a two communicate with particular Internet accessible components **2606** within the configurable VR model responsive to positioning of a user within the system. Thus, if a user was determined to be close to a Internet accessible device **2606** comprising a fan, the central controller **2606** could turn on the fan to blow a breeze on to the user as they were shown walking past a window or doorway within the VR world. This would allow control of various tactile feedback components within the configurable VR environment based upon the determined user positioning that did not necessarily rely upon sensors as described with respect to FIG. 24. Each of the Internet accessible components **2606** would be independently addressable items that may be individually and specifically contacted by the central controller **2602**.

Referring now also to FIG. 27, there is illustrated a flooring portion **2702** of a configurable VR environment model that has been constructed for a particular VR world. The flooring portion **2702** is divided in to a grid consisting of predetermined size squares that provide a map of the floor portion **2702**. Each line of the grid is associated with identifiers A through G along one axis and identifiers 0 through 10 on a second perpendicular axis. The identifiers may comprise any component as long as they uniquely identify a physical location within the floor portion **2702**. The grid may be based upon particular locations within the cargo tracks **422**. In this manner, when a wall panel **520** is placed upon the floor portion **2702** the corners of the base

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members of the wall panels may be registered according to a grid location that the wall panel corner is most closely located. In this manner, each wall panel 502 within the configurable VR environment model may have a registered physical location associated there with, and an addressable network location associated there with that may be accessed via the central controller 2602. This provides a unique and specific mapping between the physical components of the configurable VR environment model in the visual elements provided in the virtual-reality world.

Utilizing the described system, a configurable physical VR environment model may be quickly assembled by an individual providing a VR environment to a user for gaming or training purposes. Due to the configurable nature of the VR environment model, the game or training process can be changed to reflect new parameters and not be limited to one implementation. This provides a great deal more of flexibility that is much more entertaining within the gaming environment and much more instructive with respect to the training environment.

It will be appreciated by those skilled in the art having the benefit of this disclosure that this system and method for haptic mapping of a configurable virtual reality environment provides a flexible manner for creating a configurable virtual-reality environment that a user may physically interact with while operating within a virtual-reality world. It should be understood that the drawings and detailed description herein are to be regarded in an illustrative rather than a restrictive manner, and are not intended to be limiting to the particular forms and examples disclosed. On the contrary, included are any further modifications, changes, rearrangements, substitutions, alternatives, design choices, and embodiments apparent to those of ordinary skill in the art, without departing from the spirit and scope hereof, as defined by the following claims. Thus, it is intended that the following claims be interpreted to embrace all such further modifications, changes, rearrangements, substitutions, alternatives, design choices, and embodiments.

What is claimed is:

1. A system comprising:

a configurable virtual reality environment model configured to place physical walls in a location that corresponds to a virtual wall located within a virtual reality world such that when a display shows a user touching a wall in the virtual reality world the user feels a physical wall placed in the configurable virtual reality environment model, wherein the configurable virtual reality environment model further comprises;

a plurality of floor sections comprising:

a plurality of members for supporting a floor, each of the plurality of members defining at least one opening therein enabling wiring access between the plurality of floor sections, each of the plurality of members further defining a plurality of first slots for receiving an end of a cross brace, each of the plurality of first slots defining a pin for securing the end of the cross brace in a fixed position;

a securing mechanism connected to a top surface of each of the plurality of members defining a plurality of connection points for a wall panel;

a plurality of cross braces for interconnecting a first member of the plurality of members to a second member of the plurality of members, each of the plurality of cross braces defining a first hole for engaging a first pin in the first member and a second hole for engaging a second pin in the second member to maintain the cross brace in a fixed position with

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respect to the first member and the second member, wherein the plurality of cross braces maintain the first member and the second member a predetermined distance from each other; and

decking placed on the top surface of the plurality of members for providing the floor for supporting a user;

a processor configured to implement a virtual reality (VR) environment model plan generation system configured to receive VR data from a VR system and generate a plan and a parts list for the configurable virtual reality environment model;

a VR system interface for providing a connection to the VR system to receive the VR data describing the virtual reality world;

wherein the processor is further configured to implement an environment plan generator for generating a plan for building the configurable virtual reality environment model responsive to the received VR data;

wherein the processor is further configured to implement a parts list generator for generation of a parts list necessary to build the configurable virtual reality environment model according to the generated plan of the environment plan generator; and

an output interface for providing the generated plan for building the configurable virtual reality environment model and the parts list for the configurable virtual reality environment model.

2. The system of claim 1, wherein the configurable virtual reality environment model further comprises:

a plurality of wall panels that are interconnectable with each other without a need for tools;

wherein the plurality of floor sections that are interconnectable without a need for tools, the plurality of floor sections including a connection interface for connecting the wall panels to the plurality of floor sections; and

wherein the plurality of wall panels may be located on the plurality of floor sections at a plurality of angles from 0 degrees to 90 degrees with respect to a first edge of the plurality of floor sections.

3. The system of claim 2 further including a plurality of cam-lock clamps for interconnecting the plurality of wall panels with other of the plurality of wall panels and with the plurality of floor sections.

4. The system of claim 2, wherein each of the plurality of wall panels further comprise:

a support structure comprising a plurality of beams defining a rectangular structure;

at least one covering panel for covering each side of the support structure; and

a plurality of connection mechanism for connecting the at least one covering panel to each side of the support structure.

5. The system of claim 4, wherein the support structure further comprises a base member defining a plurality of slots of a predetermined length therein to enable a clamping mechanism to be placed at any location along the predetermined length of the plurality of slots.

6. The system of claim 4, wherein the support structure further comprises a pair of side support members, each of the pair of side support members defining a plurality of connection slots therein positioned to align with a second plurality of connection slots in an adjacent wall panel for receiving a clamping mechanism that passes through the aligned plurality of connection slots and second plurality of connection slots to secure together an adjacent pair of wall panels.

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7. The system of claim 4, wherein the at least one covering panel defines a grid of holes therein for receiving pegs for connecting other tactile items to the wall panel.

8. The system of claim 2 further including a vertical support member for interconnecting wall panels at a 90 degree angle, the vertical support member comprising a rectangular tubular member defining a plurality of connecting openings therein on at least two sides thereof for aligning with corresponding connecting openings on the wall panels to enable the vertical support member to be clamped to the wall panel.

9. The system of claim 2 further including an angled vertical support member for interconnecting wall panels at a predetermined angle between 0 and 90 degrees, the angled vertical support member comprising a triangular tubular member defining a plurality of connecting openings therein on at least two sides thereof for aligning with corresponding connecting openings on the wall panels to enable the angled vertical support member to be clamped to the wall panel.

10. A system for providing a configurable virtual reality environment model, comprising:

a plurality of wall panels that are interconnectable with each other without a need for tools;

a plurality floor sections that are interconnectable without a need for tools, the plurality of floor sections including a connection interface for connecting the wall panels to the plurality of floor sections;

wherein the plurality of wall panels may be located on the plurality of floor sections at a plurality of angles from 0 degrees to 90 degrees with respect to a first edge of the plurality of floor sections;

wherein the plurality of wall panels may be configured to place physical walls in a location that corresponds to a virtual wall located within a virtual reality world such that when a virtual reality display shows a user touching a wall in the virtual reality world the user feels a physical wall placed in the configurable virtual reality environment model;

wherein the plurality of floor sections further comprises:

a plurality of members for supporting a floor, each of the plurality of members defining at least one opening therein enabling wiring access between the plurality of floor sections, each of the plurality of members further defining a plurality of first slots for receiving an end of a cross brace, each of the plurality of first slots defining a pin for securing the end of the cross brace in a fixed position;

a securing mechanism connected to a top surface of each of the plurality of members defining a plurality of connection points for a wall panel;

a plurality of cross braces for interconnecting a first member of the plurality of members to a second member of the plurality of members,

each of the plurality of cross braces defining a first hole for engaging a first pin in the first member and a second hole for engaging a second pin in the second member to maintain the cross brace in a fixed position with respect to the first member and the second member, wherein the plurality of cross braces maintain the first member and the second member a predetermined distance from each other; and

decking placed on the top surface of the plurality of members for providing the floor for supporting a user.

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11. The system of claim 10 further including a plurality of cam-lock clamps for interconnecting the plurality of wall panels with other of the plurality of wall panels and with the plurality of floor sections.

12. The system of claim 10, wherein each of the plurality of wall panels further comprise:

a support structure comprising a plurality of beams defining a rectangular structure;

at least one covering panel for covering each side of the support structure; and

a plurality of connection mechanism for connecting the at least one covering panel to each side of the support structure.

13. The system of claim 12, wherein the support structure further comprises a base member defining a plurality of slots of a predetermined length therein to enable a clamping mechanism to be placed at any location along the predetermined length of the plurality of slots.

14. The system of claim 12, wherein the support structure further comprises a pair of side support members, each of the pair of side support members defining a plurality of connection slots therein positioned to align with a second plurality of connection slots in an adjacent wall panel for receiving a clamping mechanism that passes through the aligned plurality of connection slots and second plurality of connection slots to secure together an adjacent pair of wall panels.

15. The system of claim 12, wherein the at least one covering panel defines a grid of holes therein for receiving pegs for connecting other tactile items to the wall panel.

16. The system of claim 10 further including a vertical support member for interconnecting wall panels at a 90 degree angle, the vertical support member comprising a rectangular tubular member defining a plurality of connecting openings therein on at least two sides thereof for aligning with corresponding connecting openings on the wall panels to enable the vertical support member to be clamped to the wall panel.

17. The system of claim 10 further including an angled vertical support member for interconnecting wall panels at a predetermined angle between 0 and 90 degrees, the angled vertical support member comprising a triangular tubular member defining a plurality of connecting openings therein on at least two sides thereof for aligning with corresponding connecting openings on the wall panels to enable the angled vertical support member to be clamped to the wall panel.

18. The system of claim 10 further including:

at least one sensor for detecting a presence of the user with respect to one of the plurality of wall panels and generating an actuation signal in response thereto; and at least one environmental feedback device responsive to the actuation signal for providing an environmental stimulus to the user responsive to the actuation signal.

19. The system of claim 10 further including:

a virtual reality (VR) environment model plan generation system configured to receive VR data from a VR system and generate a plan and a parts list for the configurable virtual reality environment model, comprising:

a VR system interface for providing a connection to the VR system to receive the VR data describing the virtual reality world;

an environment plan generator for generating a plan for building the configurable virtual reality environment model responsive to the received VR data;

a parts list generator for generation a parts list necessary to build the configurable virtual reality environ-

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ment model according to the generated plan of the environment plan generator; and
 an output interface for providing the generated plan for building the configurable virtual reality environment model and the parts list for the configurable virtual reality environment model.

20. A system, comprising:

- a virtual reality (VR) system interface for providing a connection to a system to receive VR data describing a virtual reality world;
- a configurable virtual reality environment model related to the virtual reality world including a plurality of floor sections, the plurality of floor sections comprising:
 - a plurality of members for supporting a floor, each of the plurality of members defining at least one opening therein enabling wiring access between the plurality of floor sections, each of the plurality of members further defining a plurality of first slots for receiving an end of a cross brace, each of the plurality of first slots defining a pin for securing the end of the cross brace in a fixed position;
 - a securing mechanism connected to a top surface of each of the plurality of members defining a plurality of connection points for a wall panel;
 - a plurality of cross braces for interconnecting a first member of the plurality of members to a second member of the plurality of members, each of the plurality of cross braces defining a first hole for engaging a first pin in the first member and a second hole for engaging a second pin in the second member to maintain the cross brace in a fixed position with respect to the first member and the second member, wherein the plurality of cross braces maintain the

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first member and the second member a predetermined distance from each other; and
 decking placed on the top surface of the plurality of members for providing the floor for supporting a user;

- a processor configured to implement a VR environment model plan generation system configured to receive the VR data from the VR system and generate a plan and a parts list for the configurable virtual reality environment model;
- a VR system interface for providing a connection to the VR system to receive the VR data describing the virtual reality world;
- a processor configured to implement a virtual reality (VR) environment model plan generation system configured to receive VR data from a VR system and generate a plan and a parts list for the configurable virtual reality environment model;
- wherein the processor is further configured to implement an environment plan generator for generating a plan for building the configurable virtual reality environment model responsive to the received VR data;
- wherein the processor is further configured to implement a parts list generator for generation of a parts list necessary to build the configurable virtual reality environment model according to the generated plan of the environment plan generator; and
- an output interface for providing the generated plan for building the configurable virtual reality environment model and the parts list for the configurable virtual reality environment model.

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